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THE GEOGRAPHICAL JOURNAL

Vol. LXXI No. 1 January 1928

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THE GEOGRAPHICAL JOURNAL

Vol. LXXI—January to June 1928

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The
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Vol LXXI No 1 R.G.S. *January 1928*

TWO RECENT JOURNEYS ON THE COAST OF EASTERN GREENLAND: *A paper read at the Evening Meeting of the Society on 7 November* 1927 *by*

DR. LAUGE KOCH

THE central part of the East Coast of Greenland, which I shall tell you about to-night, was in the main discovered by British expeditions about a hundred years ago.

During my stay at Scoresby Sound I was visited by the Cambridge Expedition to East Greenland, which was conducted by my friend Mr. J. M. Wordie. In the September number of the *Geographical Journal* he and his companions have published an excellent report, and Mr. Wordie has also given an account to this Society of the British investigations in East Greenland that were commenced a hundred years ago. As for those made by himself and his companions last year, I can only express my great appreciation, as a Dane, of the good work accomplished, which will always rank high as a purely scientific venture. I might add here that Denmark looks with critical eyes upon the general type of expeditions to Greenland, which consist chiefly of hunting and moving-picture excursions.

In his lecture to this Society in the spring of this year Mr. Wordie mentioned the splendid pioneering work accomplished by Scoresby, Clavering, and Sabine, the *Germania* expedition in 1869–70, and Nathorst's Swedish expedition to the great fjords in 1899. I shall just mention here the other expeditions that have surveyed Eastern Greenland: the Danish Expedition to Scoresby Sound in 1892, conducted by Capt. Ryder; the Danish Expedition to the region between Scoresby Sound and King Oscar Fjord in 1900, led by Capt. Amdrup; and the *Denmark* Expedition in 1906–08, under the ill-fated Mylius Erichsen.

What had remained unmapped of the areas from Scoresby Sound to Denmark Harbour was surveyed and mapped by Mr. Wordie about the time that I established my headquarters at Scoresby Sound. Mr. Wordie finished his expedition by visiting me at Scoresby Sound and presenting me with a map, elaborated on the basis of his observations, which exempted me from a great work of mapping, and saved much

time that could then be devoted to geological investigations. Thus, when starting my journey northward, I was lucky to have at my disposal a complete topographical map of the regions I was going to survey geologically. How accurate this map was can best be seen from the very few corrections I have made during my sledge journeys.

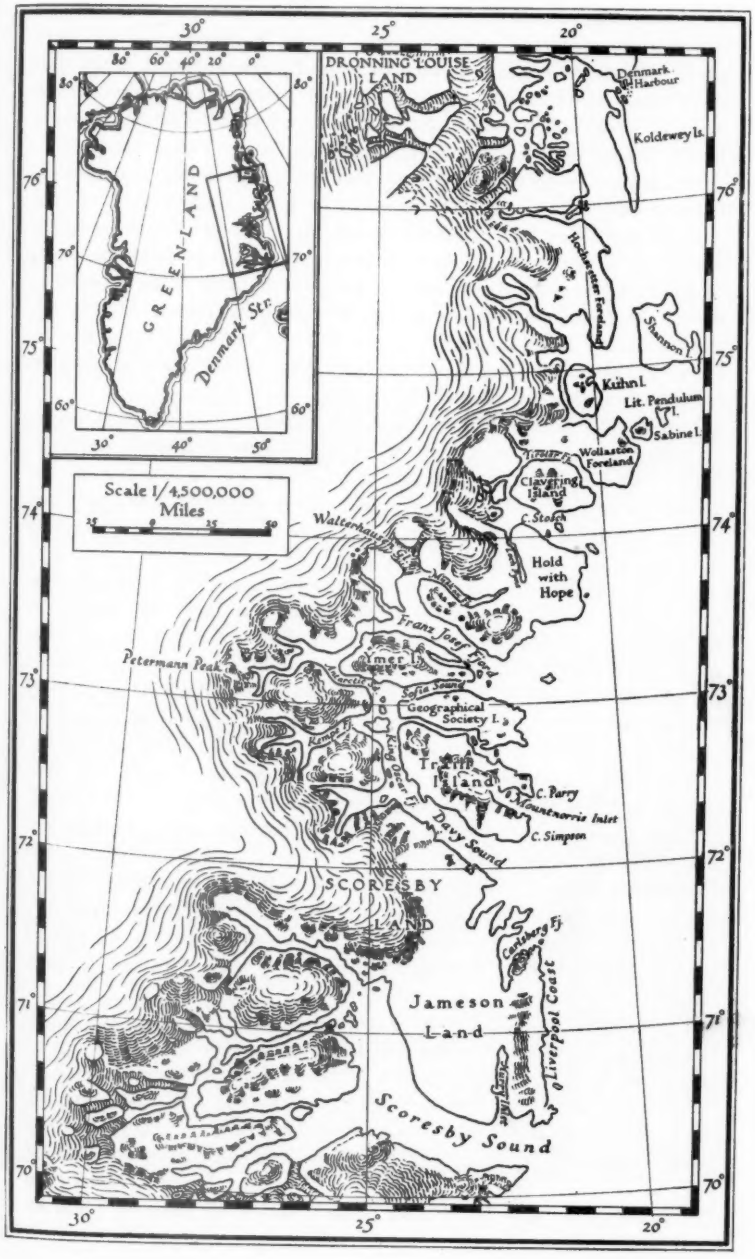
I shall now briefly delineate the preceding history and aim of the expedition. During the latter part of the war—owing to an abundance of money in Scandinavia—there was an increasing activity in East Greenland, both from the Danish and Norwegian sides. The Danish side founded the East Greenland Company, which established eight stations between Denmark Harbour and Franz Josef Fjord; chiefly relying on fox and bear hunting. This was a trading company and only slightly interested in scientific investigations.

In 1921 there was some controversy between Denmark and Norway, which was settled in 1923 by the conclusion of a treaty—renewable after the lapse of twenty years—which secured peace in East Greenland. Prior to the conclusion of the treaty, the Norwegians had established a small radio station a short distance northward of Franz Josef Fjord. This radio station is still in possession of the Norwegian State, and sends daily weather reports *via* Jan Mayen. At the radio station and to the north there are, at the present time, six Norwegian hunters engaged in catching foxes as a private enterprise.

In 1924 Denmark established the colony at Scoresby Sound under the Danish State monopoly, and about a hundred Eskimo were removed to this place from Angmagssalik. At the same time the East Greenland Company was dissolved; the men stationed in East Greenland were recalled, and the houses with provisions and outfit were taken over by the Danish State.

The following year I submitted the plan of a geological expedition to the region between Scoresby Sound and Denmark Harbour. From previous expeditions we learnt that this coast geologically is one of the most interesting regions in Greenland, and for years it has been my earnest wish upon completing my geological survey of Northern Greenland, to commence investigations upon the interesting East Greenland Coast.

In 1926 the Danish State offered to finance my expedition. My intention was to make several sledge journeys with the colony at Scoresby Sound as a base. The main object was to make a geological survey of the coast. Secondly, during my journeys along the coast I was to visit the houses on the East Greenland Coast, the reason for this inspection being that if the houses are not officially surveyed every five years the possession would be lost—this particular part being "No Man's Land." Thirdly, I had to make an economic survey of the coast north of the colony. For practical reasons the colony has been populated with Eskimo from Angmagssalik on the southern East Coast. These Eskimo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are perhaps the most skilful kayak-scullers in the world, but their sledging is extremely primitive, as the sledging season in Angmagssalik is very short. When these Eskimo came to Scoresby Sound they learned that there were nine months' sledge travelling up there, and only about seven or eight weeks' open water. So you will understand that the Eskimo had to change their technique from kayak-sculling to sledge-hunting.

When I came up there I found that the people in the colony were familiar only with the immediate neighbourhood of the colony. I had with me from West Greenland two good and well-known sledge travellers and about forty dogs. We were, on our journeys north along the coast, to make an economic survey and to study the hunting fields in order to obtain the best knowledge of the game conditions there. During my expedition the Eskimo had the opportunity of becoming familiar with the technique of the long sledge journeys, and several new and valuable hunting grounds were discovered.

Besides the Eskimo I had two assistants with me : the Danish geologist Dr. Rosenkrantz—a specialist in Mesozoic animal fossils—and Mr. Harris, who was kindly placed at our disposal by the courtesy of the University of Cambridge—a specialist in Mesozoic plants who, previous to the expedition, had published a work on plant fossils from Eastern Greenland.

I remember when I gave a lecture to this Society three years ago that during the ensuing discussion Dr. Longstaff expressed his delight at the fact that Denmark had such a great number of Arctic explorers that might work in Greenland. His words possibly implied regret that at the present time only a very few Englishmen are working in the Arctic. I often thought about these words during my expedition, especially when one of the Norwegian hunters related that Mr. Wordie's captain had expressed his admiration at the colossal power of endurance displayed by Mr. Wordie during his ascent of the mountains. I also thought of them when I saw Mr. Harris's work in Scoresby Sound, and I understood how it was that the English first investigated the inaccessible Eastern Greenland. I recall how some months ago Mr. Harris and a young Eskimo returned to my house after having walked a very long way. Mr. Harris was all right, whereas the Eskimo was worn out. I had to tell Mr. Harris that he must not overwork the Eskimo he had to help him.

The expedition had been equipped in the best manner by the Danish Government. We had two dog drivers and about forty dogs from North-west Greenland, already mentioned, and a large motor boat.

The work of the expedition was distributed thus : In the company of the two West Greenlanders I made two long sledge journeys, the first in November 1926 to Hold-with-Hope, and the second in the spring of 1927 to Denmark Harbour and back to Scoresby Sound. Meanwhile Dr. Rosenkrantz and Mr. Harris made a survey of Jameson Land by

Scoresby Sound during the summer

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motor boat and sledge, from which region they brought home not less than 8 tons of fossils.

The colony at Scoresby Sound lies immediately south of the ill-famed Liverpool Coast, which has witnessed such a deplorable number of shipwrecks. Particularly in the autumn, strong winds from the north will carry great quantities of ice into the mouth of Scoresby Sound. Bear hunting is good, whereas the seal hunting depends, to a great extent, on the ice conditions. As far as we know, local currents press the ice masses against Liverpool Coast and some distance into Scoresby Sound—the largest fjord in the world—and outside this there is often open water. These two cross-currents cause uncertain conditions immediately outside the colony. It was doubtless in this vicinity that nearly fifty ships with English, Danish, and Dutch crews were sunk by ice in 1777—the greatest catastrophe in the history of the Arctic—when their crews of more than five hundred men had to take to boats and ice-floes. Over four hundred perished during the drift towards the southern point of Greenland, after great sufferings. Whether any of these ships that were crushed by ice ever reached land at Scoresby Sound we do not yet know, but it is curious that the only Eskimo graves and houses in which we have found iron are those at the mouth of Scoresby Sound. Perhaps it was here that wrecks were driven ashore, and it is not improbable that surviving whalers have lived here with the Eskimo 150 years ago.

As soon as the ice formed in the latter part of October, I decided to start on my first sledge journey northward. The route along Liverpool Coast was impassable, the ice-floes being separated by broad belts of open water. Consequently we started towards the interior of Hurry Inlet, and were lucky to find a good sledge route behind the Liverpool Coast, a broad valley reaching a height of only 300 metres. But north of the valley, and as far as Franz Josef Fjord, the travelling was extremely difficult, the ice being pressed into all the fjords opening towards the north. Thus a fjord like Carlsberg is most likely never ice-free, and deep snow between the pressure ridges made sledging very irksome.

We carried provisions for only one week, as I had counted upon securing abundant game during the journey; but to our great disappointment we travelled as far as Davy Sound without encountering any. As provisions were running short, the two Greenlanders suggested that we should return. This however would have been a bitter blow to me, as I had hoped to reach the radio station in the early days of November. Therefore I decided, as I have always done when travelling in Northern Greenland, to go to the extreme limit of possibility, and on the next day we continued northward.

However the day passed without our having secured any game, and the next morning I gave orders that we should return. Just as the sledge was loaded two ptarmigan came flying and settled some way inland. We immediately set out to shoot them. Along the way we found a fresh

musk-ox track, and by following this trail we succeeded in killing the musk-ox, which provided us with sufficient meat for another couple of days.

The next morning we were awakened by a bear entering our camp. We managed to kill it, and cached it that it might support us during our return journey. Shortly afterwards we sighted another bear. The dogs had scented it before it became visible, and we had a thrilling race driving across King Oscar Fjord on the smooth ice free from snow. Eventually we succeeded in catching up with the bear. It fled inland, but during its flight was unfortunate enough to fall into a cleft. Naturally, it was no easy matter for us to shoot the bear, which landed only a few metres down in the cleft, and it seemed almost impossible to secure it. With some difficulty we cast a noose round its neck, and after the combined efforts of the bear and ourselves we manœuvred it out of the cleft. Unfortunately we had pulled too violently during our final efforts, and the bear was dead when we got it on to the ground. We had simply strangled it. In the evening we again saw three bears, but did not kill any. Next day we shot another, and thus had sufficient provisions for our journey to the Norwegian Radio Station.

During the return journey I surveyed the interior of Franz Josef Fjord. One day I went up in the mountains to collect fossils. I went unarmed, as I generally did when in North Greenland. Instinctively I felt I was being followed, but it was not until I was on my way back, and about 4 kilometres from the camp, that I discovered that four wolves were in pursuit of me. We reached the camp simultaneously. One of the Eskimo immediately shot one wolf, whereupon the others fled. This was the only occasion during my last expedition when my life was in danger. It was my tenth journey by sledge, so I ought to have known better than to walk about unarmed.

On approaching the colony at Scoresby Sound I discovered that a storm had carried away the ice from the mouth of the Sound, and we succeeded only with difficulty in reaching the colony in the darkness. Throughout the winter there was open water outside Scoresby Sound. The mild climate of the Atlantic spread to the land, and we experienced the rare phenomenon of having two days with rainy weather and mild climate in the month of January. In the latter part of February immense ice-masses arrived from the north, the temperature immediately fell to about 40° C. below zero, and the weather grew calm and clear.

On February 22 I started on my second journey. I was accompanied by my two West Greenlanders and an Eskimo from Scoresby Sound. Each of us had ten dogs, and otherwise our outfit was in all respects such as I have used during my previous journeys in North Greenland. We started out in deep snow, and the words " deep snow " might serve as a diary of the whole journey. We constantly hoped to find better going

Eskimo at Scoresby Sound

New Eskimo house

Eskimo house at Cape Hope

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Jameson Land

Interior of Jameson Land, Scoresby Sound

The coast from Jameson Land

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on our way northward, but time after time we were disappointed, as we had deep snow all the way to Denmark Harbour. It was only during the last few days of the journey that the travelling improved in the night, the snow being crusted with ice. Owing to the bad going it was impossible to penetrate into a great number of the fjords that I had hoped to survey more closely, and altogether it impeded our journey and forced us to abandon several interesting geological investigations.

As far as the Norwegian Radio Station we travelled along the outer coast. We had expected to encounter high-pressure ridges opposite Traill Island and Geographical Society Island, but it turned out otherwise, the ice being quite smooth but covered with immense quantities of snow—often more than 1 metre deep and with water underneath. On the southern point of Traill Island we discovered a winter lair with two bears, which we killed. It meant a valuable supplement to our dogs' food.

After a short stay at the radio station we set out towards the southernmost of the East Greenland Company's houses on Hold-with-Hope; ill-famed, as one of the hunters who lived there was killed by a bear. Subsequently we went on farther northward to another house, where a driving snowstorm compelled us to remain for four days. Again we went onward as far as Clavering Island, and were again delayed on account of a storm, till at last, on March 22, one month after our departure from Scoresby Sound, the weather cleared and we headed towards Sabine Island.

Towards evening we had drawn so near to the island that we could distinguish the house on the coast by the aid of our telescopes. Formerly it had been the headquarters of the East Greenland Company. However, we were stopped by open water—open water as far seawards as the eye could reach, and the coast itself exhibiting a perfectly vertical and absolutely inaccessible mountain wall. To try to find a way in Tyroler Fjord we considered almost hopeless, as from Clavering Island we had a view of the mountains, 2000 metres high, that form the coast in this fjord. As I then stood at the edge of the open water, I realized that I should only be able to carry the journey through to half its extent, and Peary's motto, " Find a way or make one," crossed my mind. I thought it an appalling phrase, for to find a way was in my opinion hopeless, and to build one impossible.

Possibly it was lucky that we had to fight our way the next day through a driving snowstorm from the south, for thus we had no opportunity to meditate. We had counted upon being supplied with petrol and provisions from the station at Sabine Island, as now we had only small quantities left. Therefore I had to send immediately to a house farther south to take in supplies. Meanwhile the third Eskimo and myself travelled into Tyroler Fjord to inspect the house situated there. We remained in the house for several days, going out hunting and making

geological investigations. During one of our strolls we discovered a hitherto unknown cleft, which upon closer examination proved suitable for our journey farther northward.

On April 1 we started up the cleft, and having passed the defile at an altitude of about 700 metres, we again struck the sea-ice north of Sabine Island and travelled without any sensational events, constantly over deep snow, to Denmark Harbour. We arrived there at noon on April 8.

After a short stay there, I started southward again to collect fossils on Koldeway Island. Thence we continued onwards with a driving north wind at our back. On Easter Sunday we passed the land behind Sabine Island, strayed in the blizzard into various impassable clefts, but at length reached Tyroler Fjord, after having made good finds of fossils in the clefts. Then, in the latter part of April, we attempted to travel west of Clavering Island, but had to give it up owing to deep snow; so we tried to go south of the island to Cape Stosch, but this attempt also had to be abandoned. For lack of petrol we were now compelled to go back to Carlshavn, whence we travelled overland through a hitherto unknown valley to the head of Lochfine Fjord. About May 1 we surveyed the coasts of Lochfine Fjord and the head of Moskusokse Fjord as well. After a short visit to the Norwegian Radio Station, we travelled into Franz Josef Fjord.

Apart from the two bears we had observed at the eastern point of Clavering Island and one at Denmark Harbour, we had as yet seen no bears during our journey. During the remaining part of May we observed bears daily, and could live on bear meat only. It was a great disappointment, as I had relied upon successful bear hunting. The rare occurrence of bears along the coast was no doubt due to the unusually deep snow, which kept them away from the land. The bear is very common in the pack-ice. It drifts southward on the ice-sheets until meeting open water, when it becomes aware that it has to be cautious that the ice may not melt under it, hence it goes northward towards the coast, *i.e.* northwestward. During its journey southward the bear first meets open water opposite the mouth of Scoresby Sound, where local currents cause rough ice conditions, and most likely about half the number of the bears go northward on having reached so far. They then go into the large fjords, King Oscar Fjord and Franz Josef Fjord, but never into the fjords opening towards the north, as they know by experience that these fjords are filled with pack-ice and deep snow. This year the bears came one month later than usual, and not until May did they penetrate into the fiords.

A short distance south of Clavering Island we visited the two Norwegians staying there. At the present time six Norwegian hunters are staying in East Greenland, three of whom have been trained as radiotelegraphists, and the radio station sends daily weather reports to Norway. These Norwegians are extremely skilful fox-catchers, having previously

stayed on Spitsbergen, but now it proves that the foxes are not so common in East Greenland, and that it will not pay them well to hunt, so they have decided to abandon the work next summer, when they hope to have recovered their expenses, but there will be no margin of profit.

Geological investigations were continued all the while. Thus we inspected Moskusokse Fjord, Geologist Fjord, and Antarctic Sound, and later, after having established a more permanent camp on the western side of Geographical Society Island, owing to successful bear huntings, we examined Sofia Sound, Ella Sound, Kampe Fjord, and Segelskap Fjord. Afterwards I ascended Kongeborgen, on the western side of Traill Island, to a height of 1100 metres. From there I succeeded in mapping the head of Mountnorris Inlet. Traill Island itself is made up by three high-lying areas, namely Kongeborgen, the mountains behind Cape Simpson, and the mountains behind Cape Parry, which are separated by a large plain.

The month of May we spent in the large bear district to make geological surveys there. By travelling in the night we succeeded in covering large distances despite the bad going, since in the night a crust of ice formed over the melting snow. In the vicinity of Carlsberg Fjord I ascended a mountain about 1000 metres high, and being unable to distinguish open water seawards I decided to travel outside of the ill-famed Liverpool Coast, and was highly surprised to find good going there. Throughout the winter there had been open water along the coast, but in the month of March the ice had been piled up against the coast and had remained there. During the heavy storms the snow had settled between the hummocks and we could now travel over smooth snow along this coast that, together with its alps attaining heights of some 2000 metres, represents some of the most beautiful landscapes in Greenland.

We also had another curious experience in our journey along this coast, which is about 100 kilometres long. We travelled at a distance of about 5 kilometres from the coast, and during the three days the journey lasted it was as if the air was filled with millions of invisible larks, singing constantly night and day. Naturally it was not larks, but small alp-birds, the sea-kings, that hatch in millions on these cliffs. They were flying in great flocks towards the open water to search for food, but so high up in the air that the eye could not distinguish them; we could only hear their twitter. These twittering birds are doubly thrilling here in the otherwise so silent Polar regions. Apart from the region near Liverpool Coast, I have only observed this phenomenon in Greenland in one other place, namely, in the Cape York district in North-Western Greenland, one of the best regions for catching foxes. The birds do not hatch on inaccessible cliffs but on slopes, where the foxes can easily collect eggs and young birds and store them for winter food. In the nights we were constantly troubled by foxes that approached our

camp. Liverpool Coast is the only region in East Greenland where foxes occur in such a great number that it may turn out profitable to hunt them; but of what importance this hunting ground may be to Scoresby Sound in the future cannot be stated yet.

On June 1 we arrived in Scoresby Sound, and the long sledge journey, about 2500 kilometres, had been successfully accomplished. It is generally said among the Eskimo that at the end of my sledge journeys we always ate our dogs to preserve ourselves from starvation. During this journey I had only lost one dog, which was killed by a musk-ox; I would prove that I was able to return from a long sledge journey in a decent manner. I must however admit that the dogs as well as we ourselves were more exhausted than we knew; the hard work of travelling through the deep snow had set its mark on all of us.

About the middle of July the ice drifted out of Scoresby Sound and the kayak-hunting commenced, the hunting of which the inhabitants of Scoresby Sound are still masters. It is a matter of doubt whether their children will be even as skilful in managing a kayak; more likely they will become good dog-drivers.

In the first part of August the ship arrived. It remained for about a week to unload the materials of the great new radio station and seismographic station. Then we left Scoresby Sound, and arrived in Copenhagen on August 20. The expedition had come to an end, and we had carried out the work we had set out to accomplish. The above-mentioned experiences as to the hunting grounds are chiefly due to my two West Greenlanders, who to a greater degree than I myself were experts in hunting.

APPENDIX

NOTE ON THE GEOLOGY OF EASTERN GREENLAND

Scoresby himself found sedimentary rocks with fossils in Scoresby Sound, and acid igneous rocks and basalt in East Greenland. Later on the German Expedition found Jurassic and Tertiary fossils. The Danish Expedition conducted by Ryder found out that the plant fossils which Scoresby had referred to Carboniferous were Rhætic, and this expedition also observed Jurassic. The Swedish expedition under Nathorst discovered Silurian and Devonian, and in the following year the Danish expedition under Amdrup and Hartz found Triassic and igneous rocks older than Triassic, and Eocene marine fossils. The Denmark Expedition discovered Kimmeridge and Neocomian south of Denmark Harbour, and finally, the very summer when I arrived at East Greenland, Mr. Wordie's expedition found marine Triassic south of Clavering Island.

As will be seen, fossils from the greater number of the geological periods were known before my arrival. I succeeded in finding Cambrian, Ozarkian, Carboniferous, and Permian; and thus we know fossils from all geological periods in East Greenland. It would take us too far afield to describe more closely the various localities, and I shall therefore briefly summarize the geological development of the coast from Scoresby Sound to Denmark Harbour.

In the interior of the large fjords, Scoresby Sound and Franz Josef Fjord,

Nathorst Mountains, near Fame Island, Jameson Land

Ryder Valley, Jameson Land

Neill Cliffs, Hurry Inlet, Jameson Land

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Mylius Erichsen's hut, Denmark Harbour

Eskimo with dead narwhal

Herd of musk oxen

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there is gneiss of Archæan age. Mr. Wordie's important discovery of numerous high mountains in the vicinity of Petermann Peak shows that we still know but little about the East Greenland Archæan. In the interior of Scoresby Sound, Archæan rocks form a plateau at an altitude of about 1800 metres, but farther northward the plateau seems to increase considerably in height.

In Algonkian time about 2000 metres of sediments were deposited on the border of the Greenland continent, consisting partly of red sandstone, partly of limestone, Cryptozoon reefs, and conglomerates. The East Greenland Algonkian seems to have been deposited during a longer space of time than the North Greenland Algonkian, which consists entirely of red sandstone. On top of Algonkian there are conglomerates and slates with Lower Carboniferous brachiopods. Then there is a disconformity followed by at least 500 metres of limestone, in the lowermost 200 metres of which I have found thin strata very rich in fossils, containing Olenellus, Calavia, and Strinuella, related to the Lower Cambrian Wulff River formation fauna I found in North Greenland in 1922. Higher up in the limestone there is a rather large trilobite fauna very like the Upper Ozarkian Cass Fjord formation in North Greenland, and still higher a badly preserved cephalopod fauna, probably of the arctic Black River.

In Silurian times followed the Caledonian Folding. Ten years ago I found a mountain chain of Caledonian age along the north coast of Greenland as a continuation of the Caledonian movements along the north-western boundary of Europe, going from England over Norway and Bear Island to Spitsbergen. I followed the East Greenland Caledonian mountain chain from Scoresby Sound to my northernmost point, Denmark Harbour. The folding increased in intensity from south to north, and no doubt it may be traced along the coast as far as the North-East Foreland.

In the interior of the East Greenland fjords there is a belt of more or less folded and faulted sediments, and at one place there is a thrust-plane as mentioned by Mr. Wordie. This thrust-plane is not very extensive, and it is the only one that I have seen in East Greenland.

The above-mentioned faunas are fairly well preserved, being embedded in limestone penetrated with strata of clay, which have secured that the limestone has gone safe through the folding action.

This belt of more or less well-preserved sediments can be traced from Scoresby Land to Walderhausen Glacier, and again in the southern part of Dronning Louise Land. No doubt a hitherto unknown land extends towards the interior of the ice-cap between these two points, and an investigation of this hypothetical land as the western side of the mountain chain is, I think, one of the greatest geographical problems that still remain unsolved in Eastern Greenland.

The central part of the folding extends from Musk-ox Fjord to Denmark Harbour. The sediments here have been crushed and partly converted into gneiss, and great granitic intrusions occur, but at several places (Hochstätter Foreland and Koldeway Island) the sediments are still fairly well preserved. The German expedition mentioned sediments (Algonkian, Cambrian, and lowermost Ordovician), and noticed their great resemblance to various strata in Spitsbergen, for which reason the Germans named the whole series of strata Nordenskiöld's Hekla Hook. Since then Nathorst, the pre-eminent connoisseur of the geology of Bear Island and Spitsbergen, has pointed out time after time during his journeys in East Greenland the great resemblance between these sediments and Spitsbergen Hekla Hook. As is well known, the age of Hekla

Hook is still in dispute. Only on Bear Island there have been collected a few fossils of Lower Ozarkian age, and the latest Norwegian investigations seem to indicate that Hekla Hook is Upper Cambrian, Ozarkian, and Lower Ordovician. From my investigations in East Greenland I infer that more than half Spitsbergen's Hekla Hook is Algonkian.

In the depressions between the various folded ranges there has been deposited a series of strata, at least 2000 metres thick, of red sandstones with conglomerates, gypsum, and a few Upper Devonian fishes. The East Greenland Old Red seems to have been deposited very like the Scottish, but entirely different from the Spitsbergen Old Red. On top of Devonian there are freshwater deposits, containing molluscs and remains of fish. Then follow conglomerates. I have not found stationary Lower Carboniferous, but a Triassic conglomerate at Cape Stosch contains numerous boulders of limestone with a rich Lower Carboniferous fauna, and also south of King Oscar Fjord occur strata of sandstones and limestone, several hundred metres thick and probably belonging to Lower Carboniferous. In one place has been found sandstone, containing among other plants Lepidodendron, indicating Middle Carboniferous; these plant beds are overlain by late Upper Carboniferous, and in Nathorst Fjord has been found a new locality of the well-known and widely spread late Upper Carboniferous fauna, similar to the late Upper Carboniferous faunas occurring in Spitsbergen, Northern Greenland, Ellesmere Land, and Alaska.

After these deposits had been laid down, there was much faulting and volcanic activity; so far as I can make out, faulting has taken place along the entire coast from Scoresby Sound to Denmark Harbour. The volcanoes are now marked by granite, syenite, porphyry, and some diabase. At this time Liverpool Land and Jameson Land were tilted, and for the first time in the geological history Liverpool Land was formed as an island.

In the northern part of Jameson Land we have now conglomerates, red sandstone, gypsum, and a few strata with marine Permian and marine Triassic, about 1000 metres in all. The pebbles in the conglomerates consist partly of Carboniferous and Permian igneous rocks and partly of Callovian metamorphosed boulders from Liverpool Coast. These conglomerates are decreasing in thickness towards the west. I have also collected some fossils from Wordie's Triassic locality south of Clavering Island.

The Jurassic is extremely well developed in East Greenland, chiefly in two regions. On top of Jurassic we have the famous Rhætic plant beds from Jameson Land, during this expedition especially studied by Mr. Harris, who has collected more than 200 species from these beds. Then comes Lias with at least two distinctly marked faunas, each of them comprising about 200 species, and apparently closely allied to West and Middle European faunas. Callovian contains ammonites, and also from Portland there is a very large fauna. The northern area, extending from Hold-with-Hope across the eastern part of Clavering Island, Wollaston Foreland, Kuhn Island to Koldeway Island, consists of a little Callovian, then about 400 metres of Kimmeridge, partly plant beds, partly sandstone and limestone with a great many fossils, then about 300 metres of Neocomian, also plant and marine beds with numerous fossils.

Tertiary is known from the entrance of Scoresby Sound (marine Eocene) and plant beds on Sabine Island (Eocene ?). Already in Eocene times strong volcanic activity was in progress, chiefly south of Scoresby Sound, but also in the region from Pendulum Island to Franz Josef Fjord, and occasional

Looking into Loch Fyne

Cairn at Denmark Harbour to Mylius Erichsen and his two companions

dykes and small sills occur in the eastern part of Ymer Island and Geographical Society Island and in the central part of Traill Island. Nearly all the igneous rocks north and south of Davy Sound belong to Carboniferous. Previous to my expedition it was generally assumed that there was very strong Tertiary faulting north of Scoresby Sound, but as far as I can see this faulting is not very common. Since Permian times the Liverpool Coast–Jameson Land block has moved separately several times, but not very much in the Tertiary. Hot springs are now very common in East Greenland, the hottest known from Scoresby Sound being 62° C., but also on Hold-with-Hope there are a great many fairly hot springs. A large fault extends along the western part of Traill Island, across the western part of Geographical Society Island and Ymer Island. Probably this fault is of Tertiary age.

DISCUSSION

Before the paper, after reference to the loss which the Society had suffered in the death of its President, the CHAIRMAN (Admiral Sir William Goodenough) said: We welcome here to-night Dr. Lauge Koch. No introduction is necessary to a Royal Medallist of this Society. I would like to tell you, Dr. Koch, that in a letter I received from our late President only a few days ago he asked me to express to you the great disappointment it was to him not to make your acquaintance and be able to congratulate you on your great achievements. And, Ladies and Gentlemen, it would be a very singular thing if the achievements of Dr. Koch were otherwise than great, for he has all those qualifications which make a great explorer and traveller. He is a master of his profession, in geographical survey and in all matters connected with it. As we look at him this evening I do not think we need trouble much as to his health. He has the very greatest sympathy with the inhabitants of that country which he has made almost his own, and he is imbued in a very marked degree with that one quality without which no travel, exploration, or anything else in life is any good, namely courage. We look forward with the greatest possible interest and pleasure to his lecture, which I will now ask him to deliver.

Dr. Lauge Koch then read the paper printed above, and a discussion followed.

Mr. J. M. WORDIE: It is a great privilege to have listened to Dr. Lauge Koch's splendid lecture and to recognize, though with some difficulty, places which the Cambridge party visited in the summer of 1926. I feel a certain amount of shame when I recollect that Dr. Mill told me recently how Sir James Hooker, after the return of Captain Scott in the *Discovery*, was able to recognize and name places which he had seen sixty years before with Sir James Clark Ross in the *Erebus* and *Terror*; it was with the greatest difficulty to-night that I was able to recognize the various huts after seeing them myself in the summer without snow, in comparison with the deep-snow conditions which Dr. Koch experienced. It emphasizes the extraordinary difference between summer and winter conditions in East Greenland. The settled fine weather, which in summer makes travel there so delightful and reliable, is indeed almost a misfortune in the winter: there is apparently no wind to pack the snow and give a hard sledging surface. The deep soft snow must have been very disheartening to Dr. Koch and his companions, and must have increased their labours almost fourfold. To have covered the distances he did and to have carried out so much geological work is surely a remarkable feat. I should like therefore to congratulate him very warmly on the discoveries about which he has just told us, and more particularly on the geological results.

They open up an entirely new chapter, not only in Greenland geology but also in the past history of Britain, in the matter of the former distribution of the old land masses.

Seeing Dr. Koch to-night recalls a day on the Greenland coast in 1926, when I put into Scoresby Sound for a few hours and found Dr. Koch towering head and shoulders above the Eskimo inhabitants of the little colony there. My party had finished the summer's work, but Dr. Koch had just arrived and was waiting for the winter snow. When we sailed that same night, carrying with us last letters to Denmark, those who regretted the parting most were not, I think, Dr. Koch and his companions so much as our small party; we were leaving at the very beginning of the winter season, which, as you saw from Dr. Koch's splendid photographs, is quite one of the most beautiful things there is.

Mr. T. M. HARRIS: It is a great honour to me to be asked to speak to-night, but all I will say is this: When I was going out to Greenland last year I told my friends that I was going with the Danish Expedition. One of my friends was very surprised, and when I told him that I would have to work under exactly the same conditions as the other members of the expedition he was still more surprised, and said, "That's one of the things that makes me think civilization worth while."

Dr. T. G. LONGSTAFF: I am not qualified to speak on the paper, though I am glad to have the honour of addressing you this evening. I would like to emphasize what Dr. Koch has not allowed himself, as a Dane, to emphasize: that Denmark is doing in Greenland, and has been doing for the last one hundred years without saying anything about it, the sort of work that the highbrows and the League of Nations are talking about. Denmark has run Greenland for the benefit of the Eskimo and has not asked anybody to pat her on the back or recognize her virtue. I do not think that many people at all realize what she has done. I do not believe the Danish administration of Greenland has ever paid for itself. I think it has always cost Denmark a quite considerable sum to run that country. You have heard Dr. Lauge Koch say that any English scientific expedition will be welcomed. The reason he says that is because unscientific people who would like to go there for the benefit of their own pockets know very well that they are apt to be warned off; and Denmark has made herself unpopular, in certain countries which I will not name, because she has set her face against the exploitation of the natural resources of Greenland, not from any selfish motives whatever, but simply because if the hunting resources of Greenland are exploited by Europeans it can only be to the detriment of the Eskimo.

Mr. Harris has charmingly told us what he thinks of the benefits of civilization. Well, if you will look in various other portions of the Arctic, at least in the past, you will find that the great benefits that civilization has brought to the Eskimo are disease and death. I know things are much better now: the U.S.A. are doing splendidly in Alaska through the introduction of reindeer, while Canada is liberally carrying out her responsibilities—and of course the Hudson Bay Company, which has never allowed the sale of liquor to any natives, Indian or Eskimo. But I think we should all realize, especially as the Danes do not talk about it, what they have done. For the past one hundred years they have just been doing their best for the aborigines of Greenland, and they can only continue to do the best for them if they paternally insist upon the Eskimo living a natural life, and they can only live a natural life by hunting in the Eskimo fashion and going hungry if they do not hunt. It is no good

building European houses for them, clothing them in European clothes, and feeding them with European food. That will not keep the Eskimo going. They can only flourish if they are enabled to hunt in their native hunting grounds, and we must do anything that we possibly can to support the Danes in any protective regulations they make, which we may be quite certain interested parties will object to.

The CHAIRMAN: We are honoured to-night with the presence of His Excellency the Danish Minister. I will ask him to say a word or two.

H.E. The DANISH MINISTER: As the Danish representative it is a pleasing duty for me to tender to the Royal Geographical Society my sincere thanks for the hospitality extended on s many occasions to Danish explorers, and now this evening to Dr. Lauge ch. I feel it as a personal and deep grief not to be able to express my appreciation to the late Dr. Hogarth, who, with such distinction, held the presidency of the Royal Geographical Society. His untimely death is felt not only in England but also very keenly in my own country, and in every other country where science is held in high honour. I feel proud as a Dane to have been able to be present at Dr. Lauge Koch's interesting lecture, and I am very glad to see that adventure is not dead, but that Denmark is still able to inspire a spirit of research and exploration.

The CHAIRMAN: I would like to thank His Excellency very warmly for the reference which he has made to Dr. Hogarth. He may be assured that it will be very much appreciated by all the members of this Society and by Dr. Hogarth's friends. It is my pleasant duty, Dr. Koch, to thank you most warmly for your lecture. I said that we looked forward to it with interest and pleasure. We shall look back on it with even greater interest and pleasure. The only complaint we have is that it really was too short, but the very beautiful pictures you have shown will ever remain with us. I would like to announce what I hope Dr. Koch will be pleased to learn, namely, that he has been made to-day an Honorary Corresponding Member of this Society, which we in our self-conceit think is perhaps a compliment.

Dr. LAUGE KOCH: Fourteen years ago, when I went to Greenland for the first time as a young boy twenty years of age, an old Arctic explorer told me that when an Arctic explorer returned from an expedition there were two places which would want to know what he had done—London and Stockholm. London has been the centre from which Polar exploration has started during the past one hundred years, and in that time several British men have visited East Greenland. When I returned from my previous journey and was asked to give a lecture to this Society I felt it a very great honour, but I was nervous because I was not very well up in the English language. When I arrived at Harwich from Denmark the Customs official asked me what I was going to do in England, and I said, "I am going to give a lecture to the Royal Geographical Society." He replied, "Don't tell me that." However, I spent a month over here studying the language before delivering my first lecture, and I regret that has not been possible on this occasion, because then the lecture would have been much better. I remember when the ship came in August to Scoresby Sound, for the second time I was honoured by this Society in that I learned I had been awarded the Gold Medal, one of the greatest honours I have won in my life. I hope in my future life to be worthy of keeping that Medal. This evening you have honoured me once more, and I can only thank you very much for all you have done for me in London, one of the places in which an Arctic explorer is honoured for his work. Thank you very much.

THE TRIANGULATIONS OF AFRICA: *A paper read at the Afternoon Meeting of the Society, 14 November 1927 by*

COLONEL H. S. L. WINTERBOTHAM, C.M.G., D.S.O., AND CAPTAIN G. T. McCAW

WE are to consider two problems which are not independent, but which are of different magnitudes, and which call for slightly different handling. In the first place we are considering the triangulations of Africa as a whole, or, shall we say, African geodesy. It will be seen that the time is ripe for an international agreement upon the technical aspect of geodesy, in order that we may avoid the divisions which different national ideas have forced upon Europe; and that we may come to that sort of fortunate conclusion which is, and will be, such a boon to the geodesy of North America.

The second problem is that of the surveys of East Africa. There is here the same need for a general agreement, but that agreement will be the easier reached because the surveys in question are mainly British, and because the Belgian Congo is working in close sympathy with us and has already adopted the same Figure of the Earth. But when we look at the picture of East African triangulation, the history of geodetic enterprises of this magnitude will inevitably force us to certain conclusions. What, for example, would one expect to have in place of the grand triangulation of India had the development of Indian geodesy lain in the hands of, and been conditioned by the requirements of, individual provinces and states? Should we have the magnificent contribution to geodesy afforded by the Geodetic Survey of South Africa had it not depended upon the organization, and in the case of Sir David Gill we must add the personality, of one man? Or again, when we look at the growing and healthy geodetic development in Canada, would that have been possible had it remained provincial rather than federal?

But the need of co-operation and agreement can be seen as clearly from the second problem (The Surveys of East Africa) as from the first. I propose, then, to give a brief outline of the state of African geodesy; then turn to East Africa and discuss, in relation to it, the points on which agreement seems desirable; and lastly, deal with the Arc of the thirtieth meridian.

I. THE PRESENT GEODETIC POSITION

The Survey of South Africa

The admirable geodetic survey of South Africa—a monument to Sir David Gill—covers a total length of chain of about 5000 miles, arranged in grid pattern, and connecting to a Rhodesian portion of the arc to the north and to the triangulation along the 20th meridian to the south-west. The internal spaces of the original grid are now being filled in by first-order triangulation, and a large amount of secondary and tertiary triangulation is hung on to it. The Figure of the Earth employed is Clarke

1880, and the projection is the Transverse Mercator (Gauss Conformal) in strips.

Survey of Egypt

The geodetic triangulation from Cairo to Aswan—some 550 miles in length—is of a very high order. The probable error of an angle is, in general terms, about 0·3 second of arc. The figure of the Earth originally adopted is one due to Helmert ($a = 6\ 378\ 200$, $1/f = 298{\cdot}3$), and no doubt the domestic geodesy of Egypt, including the lower orders of triangulation, will continue to be based on that figure. The positions of the arc have been recomputed on the Hayford figure, but, judging from the printed report of 1927, the result may increase the A–G differences. The positions of all trig. points are also given on the Transverse Mercator.

East Africa

The most interesting portion of Africa from the geodetic point of view is East Africa. Not only does the future Cape-to-Cairo arc run through it, with one section in Rhodesia and another in Uganda already measured, but no less than eleven boundary commissions have left their mark on future surveying. There are considerable areas of British triangulation in Kenya and Uganda, some of German in Tanganyika, and Commander Whitehouse's triangulation round the southern shores of Lake Victoria.

Of these various triangulations the most important are on Clarke's 1880 figure, although the 1858 figure and also that of Bessel are represented. Fig. 1 shows in detail the extent of these various triangulations.

Gold Coast (including Ashanti and Northern Territories)

The first systematic survey was based on a network of theodolite traverses over the Gold Coast and part of Ashanti. It was started in 1901 by Major Watherston, and completed in 1908 by Major Guggisberg, on a scale of 1/125,000.

In 1920 and 1921 a main chain of triangles about 120 miles long was carried from Accra to Lake Bosumtevi (neighbourhood of Kumasi), with a 50-mile branch from Accra to Appam. A secondary triangulation now extends between Accra and Akuse.

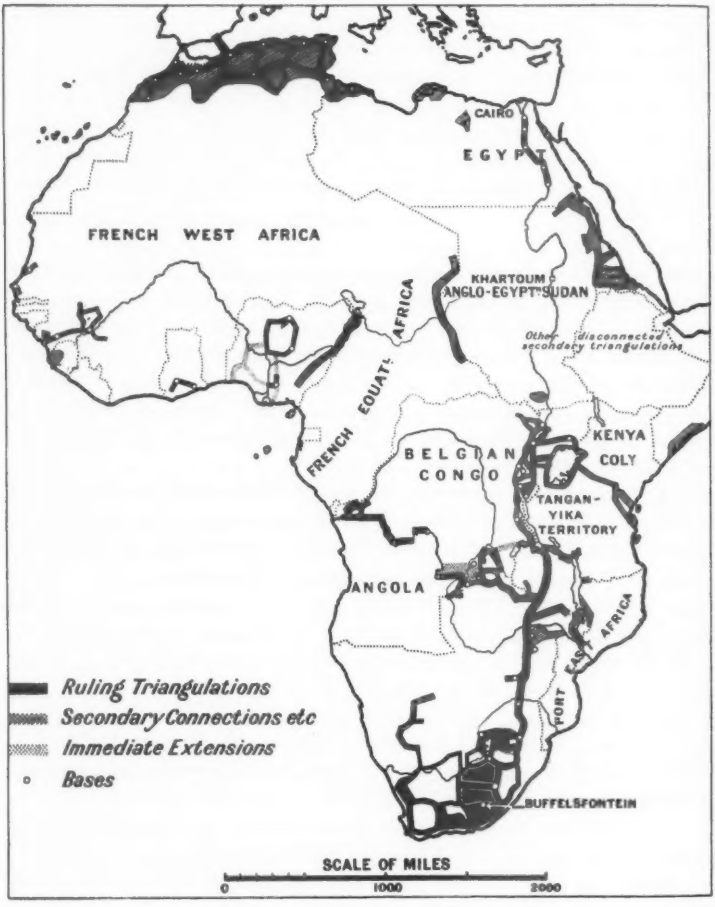
A special spheroid of reference was adopted at the advice of the War Office whose elements are $a = 6\ 378\ 300$ m.; $1/f = 296$.

Minor trig. work is computed in a single belt on the Transverse Mercator projection.

Nigeria

In 1910 Major (now General Sir Gordon Guggisberg) became Director of Surveys for Southern Nigeria, and commenced a systematic survey based on topographical triangulation and theodolite traverses. Work was in patches owing to the immediate requirements of railways and mining areas, and was extended into Northern Nigeria.

In 1914 Northern and Southern Nigeria were amalgamated into the Colony and Protectorate of Nigeria, and Major Guggisberg was appointed Surveyor-General. The war necessitated the closing of topographical work in general, but some extensions were made to the triangulations.



1. *AFRICAN TRIANGULATIONS*

Since the war a definite programme of triangulation has been agreed upon, and is being carried out slowly but continuously. Most of the original triangulations have been re-observed, and are being connected so as to produce a well-designed main control of arcs. Strips on the Transverse Mercator are used for co-ordinate position.

The Sudan

Mr. Boyce, who succeeded Colonel Pearson as Surveyor-General of the Sudan, has recomputed and adjusted some triangulations of a secondary order on the north and east. Elsewhere there are scattered patches of hasty work. The vast areas to be dealt with must make it seem difficult to embark on a definite scheme. Nevertheless, it is much to be hoped that a start will be made soon. At present nothing is being done for the future, nor will progress be likely until some definite programme is agreed upon and begun, however small its beginnings may be. Tables on the Clarke figures of 1858 and 1866 have been used.

French Northern Africa

If French triangulation in Northern Africa comes second, in that continent, to the Geodetic Survey of South Africa, it is a very close second. The chains are of a good modern first order, supported by an adequate number of bases, and providing a strong connection with Europe. Clarke's 1880 figure is used throughout.

I am indebted to General Bellot, Director of the "Service Géographique de l'Armée," for the information shown on Fig. 1.

Italian Africa

General Vacchelli, the Director of the "Istituto Geografico Militare," has very kindly sent to me the trace of Italian first-order triangulations and has shown the position of the bases on which they depend (see Fig. 1). As in French Africa, a large number of maps have been made on a framework of astronomically fixed points. These latter are however independent of that choice of figure and of tables which this paper advocates, and are not therefore shown. The Italians use the Bessel ellipsoid.

The Belgian Congo

Belgian triangulation in the Congo follows, mainly, along its southern and eastern frontiers. We have had many boundary commissions in common, remarkable for their spirit of co-operation. In addition to the Belgian share in the Uganda Arc we owe to them a number of bases and connections which should result in a particularly strong corner between 7° and 12° South latitude and 25° and 32° East longitude.

Along the Rhodesian–Congo boundary a joint commission is now at work and will add to the triangulation a number of astronomical observations (latitude, longitude, and azimuth) in order to help in the future adjustment of the framework in this area. Belgian triangulation is computed on the Clarke 1880 figure.

II. CO-OPERATION IN THE FUTURE

This very brief *résumé* of African triangulations shows that the Clarke 1880 figure, and, though less certainly, the Transverse Mercator projection, have already won a predominant position.

It is perhaps too much to hope that there should be any effective common purpose in cartography. The individual needs of the various surveys will continue to differ so much, and development will come at such different times, that topographical mapping must for many years follow convenient rather than regular sheet lines. Relatively, however, uniformity in cartography is unimportant. It is far more important that there should be no actual survey boundaries.

It becomes easier to grasp the advantages of an agreement on these matters if we consider some definite area in more detail. Now the surveys of East Africa offer an admirable example. We have here a vast territory split up into six colonies, and running directly through four of them that great meridional arc of the future from Cairo to Cape Town. This backbone is still unfinished. It is inconceivable that it should long remain so. Radiating from its completed portions lead the triangulations of eleven boundary commissions. Here and there are scattered areas of primary control. At present, however, there is no finality in any of them. It is true that the Rhodesian Arc comes directly from the Geodetic Survey of South Africa, but there is a curious and unpleasantly large difference between the astronomical and geodetic azimuth near its northern extremity. It is true also that the Uganda Arc is properly placed and adjusted as far as field measurements allow, but the longitude is carried through a boundary commission triangulation from Zanzibar, and the Ruwenzori Massif is so unpleasantly close as to cast doubts on the behaviour of the plumb-bob over indeed the whole of the arc. Now every shift in position of necessity imposes extra work upon the survey departments, if not immediately, then later. The situation may not be serious at the moment, but every additional triangulation must make the recomputation, inevitable some day, more onerous.

Watching the development of the East African Surveys, the Colonial Survey Committee asked the Geographical Section, General Staff, to draw up three documents for circulation :

(*a*) A precis of all the East African triangulations (which was illustrated by a map from which Fig. 2 is taken, but which is itself too long to reproduce here).

(*b*) Suggestions for unification of surveys (figure of the Earth, datum, and projection, with reference primarily to East Africa itself, and secondly to junctions north, west, and south).

(*c*) Suggestions for the co-ordination of Surveys in East Africa, illustrated (with the counter-proposals of the various colonies) in Fig. 2.

It is obviously important that whatever policy is chosen should be based upon the broadest of foundations. It is inconceivable, for example, that it should not provide for a complete junction with Sir David Gill's great work in South Africa. It is equally important that the arc should be completed by a junction to the Egyptian portion. It should certainly provide touch with the surveys in the Congo also.

The suggestions for the unification of these surveys made under heading (*b*) above took into consideration the following points:

Uniform Geodetic Tables

The first question to strike the geodesist in thinking of appropriate geodetic tables is whether his choice is affected by the decision at the Madrid Conference of 1924 to adopt the Hayford spheroid of 1910:

Semiaxis major	6,378,388 metres.
Reciprocal of the flattening	297

Let us see then what the decision was, and, later, what distinctive advantages this spheroid has to offer *per se*.

It was decided to adopt Hayford's as a standard figure of reference for international discussions on geodesy. It was distinctly and repeatedly emphasized that no country could be expected to undertake the recomputation of its internal geodesy in this figure. The United States of America, for example, contemplates no change from her "Clarke '66."

Secondly, it is commonly agreed that there is no particular reason to suppose that Hayford's, or any other figure, can claim for the world at large to get within 100 metres of the true length of the semiaxis major or within a unit in the reciprocal of the flattening.

It is relevant here to refer to an article by Mr. G. T. McCaw in the *Journal* for April 1926. The conclusions he comes to have not been seriously challenged, and we may say that our present-day knowledge leads us to suppose that the following elements present the closest possible approximation to the figure of the Earth:

Semiaxis major	6,378,300 metres ± 50
Reciprocal of the flattening	296 ± 1

We are not, however, faced with a purely theoretical question. Even to the whole of Africa the absolute theoretical accuracy of her geodetic tables means comparatively little. It would mean perhaps adding or subtracting the length of Bond Street to or from her 4500 miles of length. The problem is to prevent the length of Bond Street being used, in the most perplexing way, to complicate the junction of surveys at Colonial frontiers. Thus the last thing to do is to introduce fresh competitors, and the first thing to strive for is uniformity (analogous to that of North America) without considering the problems of the world beyond.

We have seen in general terms what are the various figures of the Earth employed in Africa and the extent to which minor or domestic geodesy is locked up in one or other. The conclusion indeed seems to me obvious. The "Clarke 1880" is by far the easiest figure to adopt and, whatever its faults, is sufficiently precise for the purpose. A year ago there were no really good general tables based upon it. There were South African, New Zealand, French, and other tables, but these were neither complete nor in sympathy with each other. Geodesists have often enough forgotten that there are but two "independents" in the

figure of the Earth, and that you must either adopt those given in the first instance by the author or base your alternative " second independent " upon a rigorous computation. Fortunately, the Royal Geographical Society have now published complete tables on this figure.

The Choice of a Datum

If the first of the three questions may be prejudged with some safety from an armchair, the second cannot. It is a question which must be locally discussed. The absolute accuracy of the position chosen for the datum is of relatively little practical import, but the relative accuracy with regard to it of all other points is of course a matter of the most immediate interest.

For East Africa alone the best solution would seem to lie in the determination, by wireless time signal and local time, of the longitudes of the Uganda Arc. A mean value might then be applied arbitrarily throughout the Sudan, Uganda, Kenya, and Tanganyika. The arc is however but an element. It might still include a pronounced and general local divergence from the truth. For Africa generally the question is far more difficult. It is not proposed to consider it further here and now. Obviously there are many to consult and many local interests to consider.

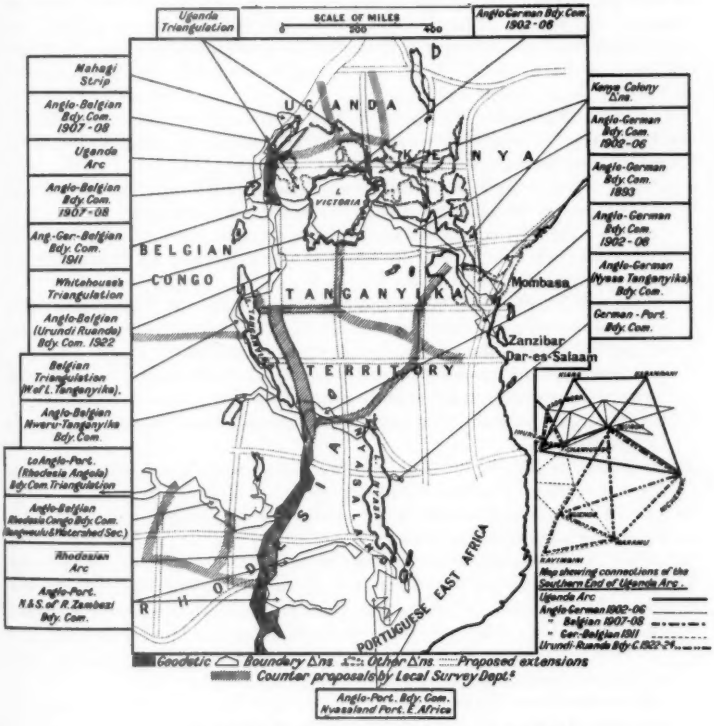
A Meridional Orthomorphic Surveyors' Projection

In the earliest days of geographical, or even topographical, surveying positions are generally given in geographical co-ordinates and maps made upon projections chosen on purely cartographical grounds. As surveys develop in scale and precision, some surveyors' projection is generally chosen in which positions can be defined by rectangular co-ordinates and, if needs be, rectangular sheet lines of maps chosen. Thus from the start of the 6-inch survey in England, positions were given by rectangular spheroidal co-ordinates (Cassini) from various county origins. These rectangular spheroidal co-ordinates have not all been rigorously computed, however. When a sufficient " control " (of rigorously computed positions) is available, inclusive perhaps of all stations of the second order, the remainder (3rd, 4th, 5th, etc., orders) may be computed by plane co-ordinates tied into the precise control. Thus, if a new survey of a property or of some smallish area is required, the co-ordinates obtained from the Ordnance Survey may be considered " plane " and the results, if properly checked, may be incorporated direct into the existing work.

The value of some such surveyors' projection is not therefore primarily cartographic. It is the essential preliminary to economy and efficiency in extending the trigonometrical framework for any surveys, whether topographic, engineering or cadastral in purpose.

So much is of course universally admitted. The choice of projection leaves more room for discussion, but even here not very much, for at both ends of the meridional strip we are considering, the " Transverse Mercator " or " Gauss Conformal " has already taken root. It is indeed

probable that no better choice could have been made. It is orthomorphic, and therefore avoids angular distortion as far as possible, and it will extend meridionally as far as may be desired. There seems but one point worthy of note. In South Africa the " Zones " or strips are calculated so as to forbid errors of scale due to the projection of more than one part in about 7000. I do not see any reason for insisting upon so small an error and curtailing thereby the width which can be covered by each strip. For the inclusion of fresh linear measurement a " scale "



2. *TRIANGULATION IN EAST AFRICA*

constant will always be required, and for cartographic work an accuracy of one part in two thousand is ample for the largest of scales.

There can be no question, however, of the value of a suitable set of strips for the whole area in question. Were trig. results to be published in terms of such a system the operations of every surveyor would be lightened, whilst the results of every fresh survey might be made immediately available for mapping and for development, irrespective of colonial boundaries.

The suggestions for co-ordination of surveys in East Africa made in accordance with item (*c*) above took the form of a statement and description of those arcs and parallels which seemed to be required as the first-order control. The statement was accompanied by a map, the outlines of which are reproduced in Fig. 2. The statement was as follows :

Co-ordination of Surveys in East Africa

1. *African Arc of Meridian :* There is no doubt as to the general course of this Arc except around the Nile Sudd region. It will probably turn off sharp to the east of Mongalla and thence follow as closely as possible the Abyssinian frontier. Whether it thereafter pursues its course down the Sobat and over to the Nuba Mountains or continues along the Abyssinian frontier to Roseires, is at present doubtful.

2. *Uganda Parallel :* This Chain of Parallel is already in progress. Passing north of Lake Victoria, it will provide the first modern offshoot from the Arc—a spur of good Secondary Triangulation.

3. *East African Secondary Meridian of* 36° *E. :* Between the Arc and the coast a strong meridional chain is required for the following reasons :

(*a*) Since the Arc lies to the west of the three colonies—Kenya, Uganda, and Tanganyika—it is not placed in the best position for linking up the triangulations of these colonies.

(*b*) It will be advisable to connect the triangulation of Kenya as quickly as possible with the Arc by means of strong triangulation ; the chain of parallel 2 forms the obvious line of interconnection.

(*c*) The Abyssinian southern frontier demands accurate survey, the connections in that region being extremely weak.

(*d*) A strong central secondary chain through Tanganyika Territory is clearly indicated.

(*e*) A good central chain could be easily carried over the Rift Valley between the Kikuyu and the Mau Escarpments.

(*f*) The Anglo-German boundary work will be strongly connected with the Arc at a point on the boundary.

4. *The Pemba Parallel :* To provide a main framework for Tanganyika Territory, in addition to the Secondary Meridian 3, chains of parallel will obviously be required. Of these the most important is the central parallel which includes Ujiji (Kigoma), Tabora, Tanga, and Pemba.

(*g*) This chain of parallel will tie with the recent Ruanda–Urundi triangulation near the Nyanza base.

(*h*) It will eventually form another spur from the Arc, when the latter is completed between Uganda and Northern Rhodesia.

(*k*) It will pick up the northern end of the good German work in the Morogoro region.

(*l*) It will give a direct connection with the old Anglo-German work at its starting from Zanzibar.

(*m*) The connections 2, 3, and 4 will give another closure on the Nyanza Base and on the latitudes, longitudes, and azimuths at Kigoma.

5. *The Tanganyika Oblique Arc :* In view of the proposed railway to the north of Lake Nyasa an oblique arc 5 will soon be wanted, following the highlands bordering this line.

At the northern extremity of Lake Nyasa this Oblique Arc will be linked with the old Anglo-German boundary triangulation between Tanganyika

and Nyasa. Thus, by way of Major Walker's triangulation, a new connection will be available between the Arc of Meridian and Uganda and that in Rhodesia, the linkage involving the new chains 2, 3, and 5. This oblique arc will also link up with the best piece of German triangulation in the small area near Tukuyu (Neu Langenburg).

6. *Parallel of Northern Rhodesia:* The configuration of Northern Rhodesia suggests a chain of parallel running from the Angola Frontier to Nyasa and crossing the Arc of Meridian somewhere about lat. 14° S. This chain would pass north of Lealui, through Broken Hill, and through Fort Jameson, connecting with the work of the Anglo-Portuguese Boundary Commissions both on east and west.

7. *Meridian of Livingstone:* An arc of meridian will doubtless be required to run north from Livingstone up to the Congo Frontier. Local needs will of course dictate priority.

8. *Zambezi Chain and Meridian of* 29° *W.:* A chain following the Zambezi, more or less, and a meridional chain from the mouth of the Kafue, through Ndola, across the Katanga Extension, and up the Luapula to the Mweru–Tanganyika section of the Congo Boundary, both appear to be indicated. In the latter work the Belgian Government would possibly participate, in so far as the portion of the chain through Congo territory is involved.

9. *Meridian of Nyasa:* The survey of Nyasaland is very backward. A strong secondary arc of meridian is clearly wanted here. It would run from Port Herald and Chiromo over the Blantyre Highlands and, gradually swinging west, turn again northwards along the watershed between the Luangwa River and Lake Nyasa. Making contact with the oblique arc 5, it would pass into Tanganyika Territory and form a component part of the ruling framework of that colony. It would be tied to the African Arc of Meridian by the connection 5; but it is more important that it should be tied directly to the Great Arc by the next chain 10.

10. *Luapula–Ruvuma Parallel of* 10° *S.:* This parallel must pass well to the north of Bangwelu, avoiding the great Livingstone Flats. It would cross Nyasa and form the survey of the southern frontier of Tanganyika Territory. This chain is of special importance by reason of the numerous chains which it would tie into the African Arc of Meridian. The connection with 9 should be undertaken, if not before, then certainly not later than the arrival of the Nyasaland chain at this latitude.

11. *Nyasa–Ruvuma Oblique Arc:* A connection to be made only as circumstances dictate the necessity.

12. *Parallel of* 7° S. *and* 13. *Parallel of* 3° *S.:* These are chains of the ruling framework of Tanganyika and Kenya. The former would start westwards from Dar-es-Salaam; the latter westwards from Lamu. Both would connect the coastal chain 14 with the Secondary Arc of Meridian 3, and would form spurs from the Great Arc when the latter is completed.

14. *The Coastal Chain:* It is clearly desirable to bind together the numerous scattered surveys along the coast, including the Anglo-Italian Boundary starting inland from Dick's Head, and link them with the chains of parallel and the ruling framework.

15. *Meridian of* 38° *E.:* The eastern boundary of the more valuable portion of Kenya Colony follows the edge of the African tableland. From this escarpment rise Kilimanjaro, Kenya, and Marsabit. Eastward of the two great massifs a chain of triangulation may be carried over Marsabit to the Abyssinian frontier. Between these last two chains, 14 and 15, lies the wilderness of which

the Lorian swamp marks the centre. The southern portion of this chain would link up the various surveys in N.E. Tanganyika and S.E. Kenya; north of Kenya the Uganda Parallel 2 would bind it to the Great Arc; and its northern extremity would aid in the accurate location of the Abyssinian frontier.

16. *The Northern Frontier Chain:* This chain would follow the southern boundary of Abyssinia and continue thence along the frontier between Uganda and the Sudan.

17. *The Meridian of* 34° *E.:* Finally, a short chain will be necessary in the future to run northwards between Mount Elgon and Lake Kioga between the parallel chains 2 and 16.

The above statement has been studied by the colonies concerned. It is evident that professional opinion is agreed upon the main lines of geodetic control, but clear too that the statement is considered a little optimistic. In several instances possible and sound alternatives have been suggested on economic grounds. The one point on which the alternative proposals seem to be unwise is in the suggestion to leave unfinished the central arc.

Boundary commission surveys can rarely be of first-class order. International agreement cannot be expected to wait on geodetic convenience. A triangulation such as the Ruanda-Urundi chain may then be ample for its purpose, but quite insufficient for the more onerous task of controlling future triangulations. The counter proposals to which reference has been made are also shown on Fig. 2.

III. THE ARC OF THE THIRTIETH MERIDIAN

The Arc of the Thirtieth Meridian supplies the natural control for the surveys of Eastern Central Africa. The vision of Sir David Gill was much more than a dream: it foreshadowed a directly practical reality. To the consummation of that fruitful undertaking the thoughts of all who are interested in the constructive development of Eastern Central Africa, on strictly economic lines, must inevitably turn. For, as Colonel Carmichael has said and the Secretary of State for the Colonies has made generally known, Survey is the foundation of all progress in the colonies. If the results of survey are to be satisfactory, and if the mistakes and grievous expenditure of the past on non-productive work are not to be repeated, it is fundamental that the control must be good. In consequence, the bringing of this great arc into full fruition demands a concentration of effort which, though costly at the beginning, will more than repay itself in a future by no means distant. But it is to be understood that the effort must be directed by the highest skill, must not be diffuse, and that the *personnel* chosen should be fully competent to conduct the operations not only with energy but also with knowledge.

The work has been executed hitherto in the face of numerous difficulties, of divers kinds. There is every reason for believing that these difficulties will be vastly lessened in the course of future work. Indeed, one may express the view that future difficulties will be found to lie more

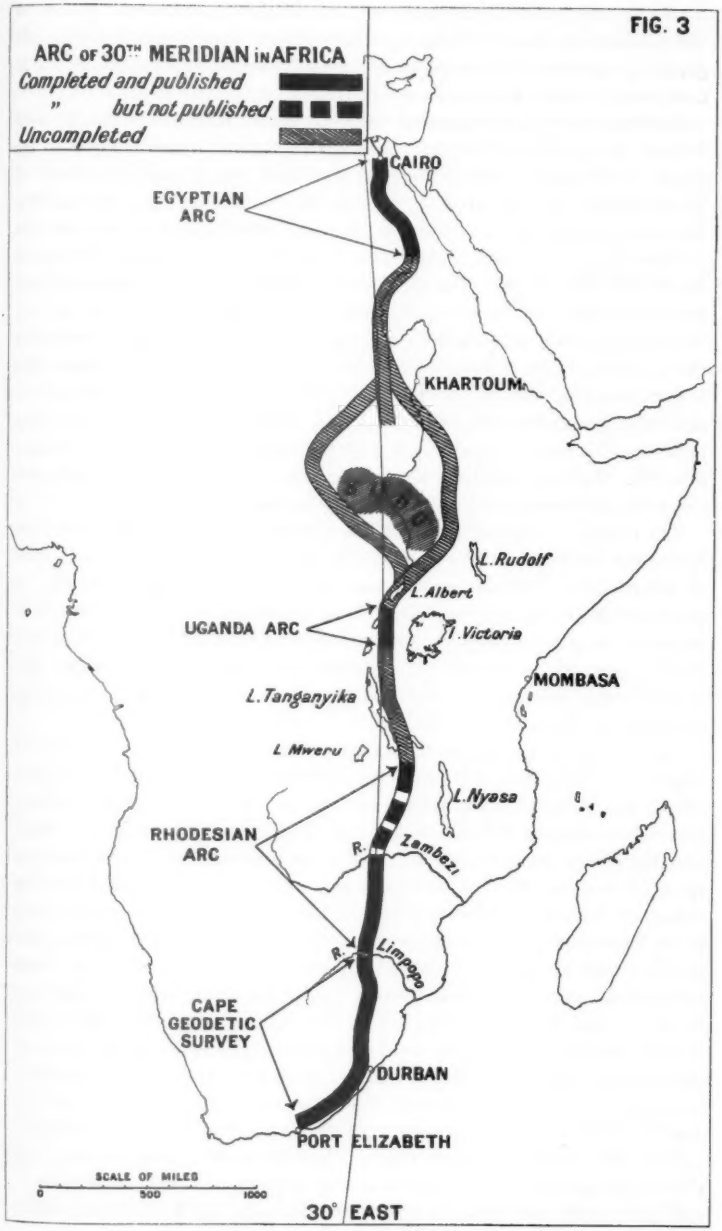


FIG. 3
ARC OF 30TH MERIDIAN IN AFRICA
Completed and published
" but not published
Uncompleted
CAIRO
EGYPTIAN ARC
KHARTOUM
L. Rudolf
L. Albert
UGANDA ARC
L. Victoria
MOMBASA
L. Tanganyika
L. Mweru
L. Nyasa
RHODESIAN ARC
R. Zambezi
R. Limpopo
CAPE GEODETIC SURVEY
DURBAN
PORT ELIZABETH
SCALE OF MILES
0 500 1000
30° EAST

in the domain of office adjustment than of field operations. A few of the troubles of adjustment have already shown themselves, and, though generally remediable, cannot be eliminated wholly until the whole arc is completed. Let us consider some of them.

Comparison of Astronomical and Geodetic Measures: As is well known, the portion of the Arc in Southern Rhodesia was completed by Capt. A. Simms before its connection with the Geodetic Survey of South Africa was executed by Col. H. W. Gordon. The result of this latter connection was to introduce a change of azimuth at the frontier stations of some 8 seconds. At the northern stations of Southern Rhodesia in the Zambezi Valley, the discrepancy between the astronomical and geodetic value of the azimuth, which Capt. Simms found to be +5 seconds, was thus increased to +13 seconds. This discordance puzzled the late Mr. S. S. Hough, His Majesty's astronomer at the Cape, who had recomputed the Arc on the basis of the standard latitude, longitude, and azimuth of the Geodetic Survey of South Africa. The Arc was subsequently carried up through North-Eastern Rhodesia by Dr. Rubin and Mr. McCaw, with the result that the A–G difference of azimuth mounted further up to +15 seconds approximately.

The change in azimuth was not the only consequence of the connection across the Limpopo River: the latitude was also affected. The adoption of the southern latitudes as standard decreased the geodetic latitude of Southern Rhodesia by 3″·5. A distinct change of A–G in latitude from negative to positive is then apparent as the Arc crosses the Zambezi Valley, and as it mounts the Tanganyika plateau this positive discordance rises to some 15″, decreasing again to about 9″ at the northern extremity of the arc.

On moving to the Uganda section of the Arc, one finds—as indeed might be anticipated in the greatly disturbed region of the Rift Valley, where the Mfumbiro volcanoes and the vast Ruwenzori massif border Lakes Edward and Albert—that the A–G in latitude is subject to rapid and relatively great variations. Thus at Nkenda, on a south-eastern spur of Ruwenzori, Dr. Dehalu's astronomical latitude indicates an attraction fron the north of some 14″; at Karangora, a northern peak of the Ruwenzori, his astronomical latitude exceeds Colonel-Commandant Jack's geodetic latitude by 20″, showing an attraction from the south of that amount; at Muruha, south of Lake Albert, the southern attraction is 16″; while farther north, across the Rift Valley, near the south-western margin of the lake, Isura is found subject to an attraction from the north of some 20″. The attractions at these stations, all lying within less than 1° of latitude, are very instructive, and indeed their directions, apart from their amounts, might with some assurance have been predicted.

The three azimuths measured in Uganda by Dr. Dehalu—who will discuss this question of attraction at the Belgian Academy of Sciences—exhibit a sufficiently good accordance; but, though the latitudes north

of the Equator reveal discordances which nearly balance themselves in the mean, this fact is doubtless accidental, and it would not be possible to derive a standard latitude from such rapidly variable measures. South of the Equator the greatest measured attraction is 5″·7, and the standard latitude of the Uganda Arc is therefore computed from the mean of the seven determinations of the A–G in Southern Uganda.

This standard latitude has no doubt considerable weight, but, for all that, should not be regarded as fixed for ever. There may well prove to be some underlying tendency to discordance common to the whole of the length (none too great) of this element of the Arc.

The longitude of the South African sections of the Arc is dependent on the longitude of the Cape Observatory; that of Uganda on the secondary chain inland from Zanzibar; while that of the Egyptian section of the Arc is dependent on the Eastern Longitudinal chain *via* Alexandria and Suez, which was continued by Zanzibar to the Cape.

The examples of the differences between the astronomical and geodetic values of the latitude and azimuth, adduced above, suffice to prove that the values adopted as standard at present cannot be accepted as definitive. Moreover, no standard geodetic datum should be fixed for East Africa until the whole Arc is complete from the Cape to Cairo.

Unfinished Sections: The stretches of the Arc which remain undone may be described with sufficient accuracy as those of Tanganyika Territory and the Sudan. The former should present no special difficulty in the field, though it may be anticipated that the influence of local attraction will be far from negligible, particularly in the sense of longitude. The same remark will almost certainly be found to apply to the continuation of the Uganda section northwards to the Sudan. In the Sudan deviation of the vertical would very probably be generally small were it possible to follow the course of the White Nile throughout. But it is precisely here that field difficulties begin. The writer is convinced that the Nile cannot be followed throughout: the cost of erecting towers in the midst of the Sudd region would be prohibitive, were it indeed considered possible to make the attempt. The Sudd region must be circumvented; but this implies a big deviation either to the east or to the west. One must either seek the Abyssinian foothills on the east or swing far round to the west, outflanking the Sudd rivers of the Bahr-el-Ghazal. The eastern course itself involves two possible routes, one down the Sobat to the Nuba Hills, the other following the Blue Nile. These loops are shown on the sketch-map, where the general course of the Arc is illustrated.

Secondary Chains: Though the Tanganyika section of the Arc has not yet been undertaken, the sections in Northern Rhodesia and Uganda have been connected by a secondary chain, whereof the results have just been computed. This secondary chain consists of a portion of the Mweru–Tanganyika triangulation, executed by Major Walker and Capt. Wynne, of a Belgian triangulation along the western shore of Lake

Tanganyika, and of a joint Anglo-Belgian triangulation recently completed for the fixing of the boundary between Tanganyika Territory and the new Belgian provinces of Ruanda and Urundi. Of the three component chains, the second is linked to the third at the Nyanza Base, near Kigoma, on Lake Tanganyika. These chains have been rigorously adjusted by the joint efforts of Commandant Maury and Colonel Winterbotham, and the accordance at their junction is remarkable. It is to be noted that a base equation was introduced in the first and second component chains, which connect the Rhodesian Arc with the Nyanza Base; and similarly a base equation was introduced between this latter base and the Uganda Arc. On the other hand, there were cogent reasons for omitting an azimuth equation. The results at " Base South-West " are as hereunder :

	Latitude	*Longitude*	*Az. Rubungu to Base S.W.*
From South ..	4° 20′ 30″·718 S.	29° 35′ 52″·806 E.	277° 21′ 37″·61
„ North ..	34″·705 S.	51″·751 E.	29″·81
South *minus* North	−3·987	1+·055	+7·80

Unfortunately, the agreement in these results must be considered somewhat illusory. The agreement in the longitude is probably the most satisfactory, for the longitude of the Uganda Arc was never considered as more than provisional; so far as it goes, it adds undoubted weight to the work of the Anglo-German Boundary Commissions from Zanzibar to the Thirtieth Meridian. We have seen that the geodetic latitude at Mpange, the northern extremity of the Rhodesian Arc, is below the astronomical by some 9″; were this added to the southern latitudes, the sign of the discrepancy would be reversed and the difference would be +5″. The comparatively good agreement in azimuth appears much more doubtful: if the A–G value of +15″ were added to the southern azimuths, the difference at Nyanza would amount to nearly 23″. Considering, however, that the chains, at least in general, were of a low secondary order and that there is an element of doubt in the azimuth at Mpange, we cannot regard the junction at Nyanza as wholly unsatisfactory.

New Chain: A chain has been run recently from the Uganda Arc to the Eastern Province of that Colony, where a base, azimuth, and latitude were measured. The average error of closure is 2″·9, and the average correction to an angle, as shown by the adjustment, is 1″·4. The triangulation made the measured base too long by 1/12,000—a discordance in excess of anticipation. The observed azimuth differs from the geodetic by 2″ only, and the observed and computed latitudes are in excellent accord. Mr. Dyson Blair, Director of Surveys, and his enthusiastic assistants are to be congratulated on the completion of this new secondary chain.

The chain was carried southwards at its extremity in order to pick

up some of the Anglo-German Boundary stations. Again there is a very fair agreement in scale, latitude, and longitude, adding further weight to the work of these Commissions.

It is hoped that good secondary spurs, of accuracy at least equal to that of the new E.–W. chain in Uganda, may be undertaken shortly in Northern Rhodesia and Tanganyika Territory. The Uganda spur might well be carried into Kenya at once, since it would connect the settled areas of the Uasin Gishu plateau directly with the Arc of Meridian.

DISCUSSION

Before the paper the CHAIRMAN (Lord EDWARD GLEICHEN) said: It is hardly necessary for me to introduce Col. Winterbotham, who is to give us what I am sure will be an interesting address on the Triangulations of Africa. He, as you know, is a member of our Council and Chief of the Geographical Section, General Staff. He has done most valuable work, not only in France during the war, but ever since, and on a very large scale. What he is to explain this afternoon is the co-ordinated triangulation of Africa, considered from two points of view: firstly from the international standpoint; but this he is not going to press so much as the second, which regards the co-ordination of the bases of triangulation not only in South Africa but along the east coast and up through our colonies in Eastern Africa. It is rather a complicated subject, and I will therefore not discourse further on it, but ask Col. Winterbotham to address us.

Col. Winterbotham then read the paper printed above, and a discussion followed.

Col. Sir CHARLES CLOSE sent the following note: I have read Col. Winterbotham's paper with entire general agreement. It seems to be most desirable that the various territories concerned should hammer out a general scheme of triangulation, and should accept the same Figure of the Earth, Datum, and perhaps also, a Projection and Series of Zones. It is not too late to settle these matters now; but it very well may be too late in a few years' time. As regards the choice of a Figure, I think that this matter should be considered not only with regard to Eastern Africa, but should be thought of with reference to the whole of Africa. It is, perhaps, rather unfortunate that Clarke's 1880 Figure should have the best chance, on practical grounds, of being selected, because, although his major axis is close enough to more modern values, his compression differs rather widely; in fact, the 1866 Figure is actually better. However, the great thing will be to get a general agreement. Personally, I should vote for the figure which has the greatest chance of general acceptance.

As to the scheme of triangulation suggested by Col. Winterbotham, I have no doubt that it will be an admirable one to adopt, if the various colonies will accept it. It could be made somewhat less expensive if, instead of two central meridional and two central longitudinal chains through the Tanganyika Territory, one in each case were accepted as sufficient; but that would be a matter for discussion. Of course the Meridional Arc No. 1 is of fundamental importance, and should be executed at an early date.

The old boundary commission work is wisely ignored, for the most part. The work I know most about was only fit for its immediate purpose.

Col.-Commandant E. M. JACK (Director-General, Ordnance Survey): I would like to make one or two brief comments on the paper. The Geographical

Section of the General Staff, of which Col. Winterbotham is the head, is in an excellent position to act as a co-ordinating centre for geography and geodesy for the British Empire. I do not know that it is actually described as such on paper, but there is no doubt that in practice it does much valuable work as a centre of advice and suggestion. Col. Winterbotham has dealt with the two questions, the geodesy of Africa and the surveys of the portions of the British Empire that fall in Africa, chiefly those in East Africa. With regard to the question of Africa generally, that of course gets outside the Empire, but I think with the excellent relations that obtain between ourselves, France, Belgium, and Italy, there is no question that we shall be able to reach, some time or other, general accord.

When we come to the question of geodesy and triangulation and surveys in the British Empire we are up against the question of how the British Empire is run. As we know, it is not by orders or discipline, but entirely by requests, advice, and suggestions. We have seen how the Geographical Section, with Col. Winterbotham at its head, has, on behalf of the Colonial Survey Committee, made various suggestions as to co-ordination of the various colonies in Africa. One cannot help thinking that it would be an advantage if some one could give the word that if and when triangulations were carried out in our colonies in Africa they should be done on certain lines. It would cost nobody anything more and it would certainly be to the general good. However, those things are not done by us in that way, and this is not the time or place to discuss whether it is right or wrong, but I think we may say that the result of Col. Winterbotham's suggestion generally is encouraging. The suggestions for co-ordination have been put forward and accepted by several of the Surveys in a very practical way. They have made certain counter-proposals. These things always take time and require patience, but I think the outlook is hopeful. Nevertheless, it does seem to me to point to the need for some kind of central department not in England, but locally, which would help this co-ordination. We hear occasional rumours, through the newspapers and so on, that some kind of combination or federation of that great group of colonies that lie in East Africa may take effect some time with regard to certain matters. It is all very much in the air, but one hears rumours of that sort. If such a thing does come off one hopes very much that survey will be one of the questions included in such general co-ordination, and it would seem that there would be a possibility of some central department in Africa which could advise on such co-ordination, which could actually carry out certain work, and could relieve the colonies of the triangulation of certain geodetic lines. Such a department need not be large ; geodetic work can be carried on by a small party and done slowly ; it would not cost much, and the cost could be shared between the various colonies concerned. It seems to me that such a thing might be well worth bearing in mind.

About the 30th Meridian Arc, as Sir Charles Close, Col. Winterbotham, and Capt. McCaw have said, that Great Arc ought to be finished. So much work has been done of the very highest order that it would be a crime to leave it unfinished. It is the backbone of precise work in Africa.

There is just one personal remark I should like to make. A portion of that Great Arc known as the Uganda Arc has been mentioned in connection with my name. I would like to make quite clear that though I was in charge of a certain amount of the work the proper way to refer to it is that I was associated with Capt. McCaw in carrying it out. Capt. McCaw brought all the knowledge and experience of that type of work, and anything that I have ever learnt

of geodetic observation or computation I learnt from Capt. McCaw while engaged on the survey of the Uganda Arc.

As to the Figure of the Earth, as Col. Winterbotham said, when one sees this great opportunity of Africa one wonders at once whether it is the right occasion or not to put into practical effect the international Figure—Hayford's figure—that was agreed at Madrid. Personally, I do not think it is a very important question whether the Hayford figure is the best or not. The whole question is one of uniformity. If the Hayford figure is likely to produce greater uniformity, by all means adopt it; if not, adopt some other figure. There is no question, to my mind, from what Col. Winterbotham has told us, that as a matter of practical politics the thing to do is to go for the Clarke 1880 figure, especially as we have now good tables.

Col. Sir GERALD LENOX-CONYNGHAM: I did not expect to be invited to speak on this paper, as I have no African experience whatever. A matter, however, on which I might say a word is that of choosing a datum point. It does not seem to me to be very important whereabouts on a chain of triangulation or on a continent the datum may be placed. It certainly seems to look nice to have it in the middle, but I am not sure that it really matters. I think it is rather important to choose a place at which the plumb-line is not likely to be much deflected, and in choosing the spot I would be guided by its topographical surroundings. If it were possible I would like to make a computation by Hayford's method and find a place where that calculation indicated that the attraction would be small. For without binding ourselves entirely to the Hayford hypothesis, we may admit that it does no doubt give a very good indication in normal country of the amount of deflection that is probable. But one cannot make such a calculation unless one has tolerably detailed topographical maps of the region, and I do not suppose in any central part of Africa such maps would be available. It seems to me more important to choose the datum point by its topography, for the sake of the probability of absence of deflection than from its central position.

Mr. G. S. LAIRD CLOWES: I am afraid I can add very little to this discussion, for my acquaintance with geodetic work has only been as a very junior assistant at the time when the Geodetic Survey was started in Egypt. But in my time in the Near East I had considerable experience of the practical need of triangulation and the extreme difficulties in which one becomes involved in any country which has been surveyed without triangulation. It is for that reason that I welcome the point, so strongly made by Col. Winterbotham and other speakers, as to the great economic importance of a good triangulation. It happened that after much work on large-scale maps for irrigation purposes in Egypt, where we have a reasonable triangulation, I was suddenly called upon to do the same sort of work in the Sudan, where triangulation has not been used effectively. The difficulties of getting any concordant system of maps over a length of some 100 miles or more, when none of those maps were based on triangulation, was tremendous. I am sure that this must also have been the experience of everybody who has had occasion to carry out mapping for any public works, extending over considerable distances, in untriangulated countries.

Brig.-Gen. G. E. SMITH: Like everybody else, I agree that coordination of all these triangulations would be a great blessing. It would have been a great blessing when one started the Anglo–German Boundary in 1893; it would have been a greater blessing when I started your boundary in 1904; and still more would I have liked it when I was in charge of the Survey Depart-

ment in British East Africa, which is now called Kenya. All we could then do was to start frameworks, hoping that some day somebody would connect them together.

I also should like to ask more about the proposed datum for the whole of Africa. In the papers that I received quoting details of the Surveys it is pretty clear that taking this bit of the Great Arc in Uganda as a datum we get very considerable corrections of latitude throughout East African work. Of course, in a sense it does not matter, but it is more convenient if the A–G works out small; more convenient in a good many ways. From experience of the three surveys I mentioned it would seem that the local attraction at three places, Mohuru, Vilima Viwili, and on the Athi plain, was unusually small, because comparing the astronomical and triangulated latitudes at these places, the discrepancies, A–G, came out very small.

The worst of adopting any such place as your datum is that it is off the main arc. You can only do it if it is really connected by high-class work with one of the cross east and west arcs which are now proposed. Still, I should like to know more about how nice the A–G looks at the points selected by Col. Winterbotham. It is rather inconvenient to have it large.

I should think that rectangular coordinates would become inconvenient if you have an origin along your main central arc; that they become inconvenient by the time you get as far from them as Mombasa, a distance of some 800 miles. Such errors would not matter on your small-scale maps, but they would matter when joining up property surveys to a consistent system of rectangular coordinates. We did adopt such a system in East Africa, making Nairobi, which was about the centre of the country, also the centre of reference.

In conclusion, I would like to emphasize the importance of some central authority having control of the chain, because local authorities have an inevitable tendency to want one to survey wrong places, places that do not fit in with the chain line, instead of starting where you can join up with somebody else. They make you start where they want to plank down some settlers, and the unfortunate thing is that the wretched surveyor, if he has started in the wrong place, when he makes his connection, has to apply a whole lot of corrections to all his work, which is an awful nuisance! I hope that this discussion may lead to a greater unification of surveys.

Mr. A. R. HINKS: I should like, if I may, to refer you again to the slide which Mr. McCaw put on the screen, and to make a remark suggested by our recent meeting at Prague, and another suggested by Sir Charles Close's note. The meeting will remember that one of the points about the great 30th Meridian Arc in Africa is that it can be connected some day with Struve's great Arc of Meridian from the mouth of the Danube to the North Cape; and that, between them, from Port Elizabeth to the North Cape makes much the longest arc of meridian that can be measured upon the surface of the Earth. But there are weak points about it imposed by its geography: a weak point on account of the Sudd; and a weak point in the Mediterranean, because of the difficulty of getting across that sea, just as there is difficulty in getting across the Sudd. There is also a weak point in Struve's arc where the chain is reduced to a single point on an island in the Baltic. Now recently the States around the Baltic have been making admirable progress in their geodetic work, and one of the things which certainly will be done in the near future is a Circuit of the Baltic, to which Struve's triangulation and various others will be attached.

At Prague there was a good deal of discussion on a connection between Struve's arc and 30th Meridian Arc: whether it should be carried round

through Syria, or whether an attempt should be made to obtain a rather fantastic kind of junction between Crete and Sollum on the coast of Africa, by various speculative devices of observing on lights fired from aeroplanes, and other decidedly romantic methods of survey. But what came out in the discussion was that the real way is to make a circuit of the Eastern Mediterranean and to go round through Syria, along the north coast of Egypt, through Libya, across to Italy and the Balkans, and so interpolate in the arc a circuit. That would make two circuits. Naturally enough, when I saw those alternative proposals in Col. Winterbotham's scheme it occurred to me that probably the solution there is the same: that one should have a circuit round the Sudd, of which a long part would be on the watershed between the Congo and the Nile. I would like to suggest that this great arc will most likely in the end prove to be three circuits connected by chains of triangulation rather than one single chain.

Apart from that, there is a remark in Sir Charles Close's note about which I wish to say a word. He sent me a copy of his note, in which is one phrase to which I must, with great respect, take exception. He speaks of Clarke's figure of 1880 as being worse than Clarke's figure of 1866 in the flattening. Now I do think that recent work has shown that no one is entitled to say at the moment that any value for the flattening of the Earth between 292 and 300 is certainly worse than any other. It is perfectly true that there is the 297 adopted at Madrid, while on the one hand we have the fact that Bowie by his gravity surveys has found a very great deal of evidence for over 300 in the United States: and on the other hand we in Europe have found great evidence for something much more like 1/293½. So far as India is concerned there were interesting recent figures by de Graaff Hunter which gave a figure of less than 293. We do not even know at present—the evidence is definitely conflicting—whether there is such a thing as a general flattening, because we do not know whether the Equator is a circle or an ellipse. I think we are going back to the idea started by Clarke, and borne out to some extent by Helmert, that there is a good deal of evidence that the equator is an ellipse; and in that case, although there might be a mean flattening for the Earth, and it might be 1/297, as astronomical physicists want us to believe, yet that does not make it impossible that the flattening may be 300 in the United States and 293 in Europe and Africa. Therefore, I do not think on that one point we can quite agree with Sir Charles Close that Clarke's figure of 1866 is better than the figure of 1880.

I should like to say that I am looking forward with the greatest interest to plotting those values of A–G that Col. Winterbotham has so ingeniously got out, upon those diagrams to which he has made such kindly reference.

Col. WINTERBOTHAM: Sir Gerald Lenox-Conyngham has said valuable things about the datum, and it is not easy to disagree with him. It is, surely, not very important either where the datum is or what figure is adopted, so long as measurement in the field does not quarrel with the results got by computation. On the other hand, we are not certain what curvature suits Africa best. It is useless to wait for the completion of the arc in order to make a new figure, because there is already so much capital locked up in the 1880 figure that no other seems possible. But if we accept a figure without being certain of its suitability we should put the datum as near the centre of Africa as we can.

Much mapping is being done in French and Italian colonies and in the Gold Coast and Nigeria, and will be done increasingly throughout Africa, from a mixture of astronomical control and air-photo topography. If the

datum is near one extremity the surveyor at the other may get astronomical results plottably different from those of triangulation.

I was asked about the maps. They are good enough generally to give a fair idea of topographical attraction, I should think. There are ¼-inch maps all over East Africa, which is, at any rate, better mapped than South America or many parts of Asia, though of course there is a very great deal still to do.

General Smith also brought up the question of the datum, and he would have wished to place it away from the arc. Everybody in Africa will want, of course, to put the datum on to his own triangulation. It was only as a temporary expedient that I suggested that it should be on the present Uganda Arc. Until the whole arc is complete there can be no certainty on the Uganda portion. General Smith suggests stretching the projection from Uganda to Mombasa. That is not possible. It is a common rule to extend strips as wide as is consistent with an error of 1 part in 2000, but not wider. In South Africa the rule is 1/7000.

Mr. HINKS: Is not there an advantage in having the datum on the equator?

Col. WINTERBOTHAM: I do not see why there should be, but there seem to be two striking nerve-centres near it. The first is where France, Belgium, and ourselves meet north of the equator. The second south of the equator is where the Belgian triangulation from South Congo and our own triangulations threaten to make a strong figure. I think we ought to try to find some datum point either on one of them or between them, so as not to get too far away from the centre of Africa.

Sir GERALD LENOX-CONYNGHAM: I would like to say that when I spoke of not insisting too much on a central position I had not at all in my mind a point so very far from the centre as Buffelsfontein. I thought that what had been said was that the datum point should be chosen on the small piece of triangulation near the Ruwenzori district because of its central position. To adhere to that central position in spite of its neighbourhood to the great Ruwenzori mass would be a mistake. It would be better to choose a place either farther north or farther south. For instance, if we could find a place somewhere in Northern Rhodesia which was free from topographical objection, that would not, I think, be so far from the centre as to make it unsuitable.

The CHAIRMAN: I think, in spite of General Smith's somewhat irreverent remarks with regard to settlers, that we have all been convinced of the enormous importance, first of all, of having a meridian arc definitely laid down throughout the length of Africa, and secondly, of getting as much coordination as possible from our own colonies, in East and South Africa in particular. We may safely leave the whole matter where it is at present, and congratulate ourselves on Colonel Winterbotham being a thoroughly reliable authority, to whom the Colonial Survey Committee can at any time refer. I think you will agree we have listened to an extremely interesting lecture, and trust you will signify your gratification in the usual way.

THE DIVISION OF THE ALPS INTO REGIONS

DOUGLAS W. FRESHFIELD

IN 1924, in pursuance of a vote passed by the Ninth Congress of Italian Geographers, held at Genoa, the President of the Italian Geographical Society nominated a Commission charged with the task of forming a comprehensive scheme for the division of the Alps into Regions and Districts. As the result of ten sittings this body, after agreeing on the general principles applicable, and going fully into the orographic details involved, presented to the President of the Italian Geographical Society a unanimous Report, an analysis of which (with a map) has been published in *L'Universo*, Anno VII. No. 9, for September 1926, the organ of the Military Geographical Institute of Florence.

It may be interesting to our readers to compare the conclusions arrived at by the Italian Commission with the systems previously set out and adopted by Continental and English geographers and Alpinists. They will be glad to learn that they are not called upon to question in principle the main triple division accepted in this country by John Ball and Coolidge; and further that it is not proposed to follow the lead of some recent Continental authorities, who have abandoned the classical names for Alpine districts—Graian, Cottian, Pennine, etc.—which are familiar to all educated ears. But where it is proposed to modify the limits of these regions and districts the suggestions of the Commission must call for our respectful but critical consideration.

The governing principle accepted by the Commission is a sound and practical one. It has simplified the task put before it by discarding the various considerations which have hitherto more or less influenced many scientific students. It has, for example, set aside arguments based on racial or linguistic considerations, or on geological, climatic, or botanical conditions. It has altogether ignored political frontiers. It has preferred to look on the Alps as from an aeroplane with a single eye to their Surface Relief, and has parcelled them out accordingly into three Regions and many minor blocks or Districts. Where possible, it has adopted for boundaries river-valleys and the passes or gaps they lead up to rather than mountain crests.

Before we discuss the sub-division of the Alps into Districts we must deal with the determination of the main Regions of the range. It has generally been considered as divisible into three sections, the Western, Central, and Eastern Alps. Some French and German geographers have preferred, however, to reduce these to two, taking as their line of demarcation either the Reuss and St. Gotthard, or the Hinter Rhein and the Splugen. The objections to this course have been forcibly stated by Coolidge.* In the Central Alps the traveller observes a marked and

* 'The Alps in Nature and History,' and *Encyclopædia Britannica*, Article "Alps."

distinctive character which affects the landscape as well as the people: "Swiss" scenery is, he recognizes, different in some of its chief features from that of the Tyrolese or of the French Alps. It is with pleasure, therefore, that we find that the Commission accepts the division of the range into three, rather than two, main regions. It remains to discuss their several limits.

In the case of the Western Alps the Commission takes the Col di Cadibona (1510 feet) behind Savona, sometimes called the Col d'Altare, as the limit between Alps and Apennines and the starting-point of the former. This is the obvious natural boundary, and far preferable to the Col di Tenda, the range to the east of which retains for some distance its Alpine character.

The Col of the Petit Ferret at the eastern end of the Mont Blanc range is adopted for the north-eastern limit of the Western Alps. Some English authors have drawn it at the Simplon, thus annexing the whole Pennine Alps to the Western Alps. This may be convenient as a division for handbook writers; but it cannot, we think, commend itself to orographers, and the Petit Ferret may be accepted as a reasonable proposal.

The boundary between the Central and Eastern Alps is a far more disputable matter. Any good physical atlas will indicate an obvious line in the valley of the Adige, the Reschen Scheideck, the valley of the Inn, and the Arlberg Pass. This in some respects is, in Coolidge's words, "an almost ideal line of division," but, as he goes on to point out, it has one fatal defect: its adoption would compel us to include in the Central Alps some of the most important ranges of the Tyrol: the Ortler, the Adamello, and the Brenta Dolomites. The Commission however surprises us by preferring a still more eastern boundary: the Brenner road from Bolzano to Innsbruck. Thus the Eastern Alps are robbed of those essentially Tyrolese groups, the Oetzthaler and Stubaier Ferner, neither of which has a connection of any sort with the Central Alps. We prefer to follow a line, suggested first and independently by Coolidge, drawn from the head of the Lago d'Iseo up the Val Camonica, over the low Aprica Pass (3875 feet), and so by the head of the Val Tellina and the historical Umbrail Pass (8242 feet), often confused with the loftier Stelvio, to the Reschen Scheideck (4902 feet).

In the east the Commission extends the limits of the Alps in their sub-alpine districts over a large extent of foothills, and as far as Vienna, Graz, and Fiume—we see no reason to question their determination in this quarter.

We now turn to consider the sub-division of the Alps into *Districts* adopted by the Commission. The following is a table of these sub-divisions. We set them out here as demarcated on the map published in *L'Universo*, on which that produced in this number of the *Journal* is based. (See folding map following page 112.)

FIRST DIVISION. WESTERN ALPS

1. *Maritime Alps.* Col di Cadibona to R. Verdon on the west and Col della Maddalena (Argentière) on the north.
2. *Cottian Alps*, from Col della Maddalena to the Mont Cenis on the north and the Galibier and upper Durance on the west.
3. *Graian Alps*, from the Mont Cenis up the Val d'Aosta to the Petit Ferret, down the Dranse to the Rhône and then by the Trient valley and Arve valley, through the Mégève gap and, following the course of the Arly, Isère, and Arc, back to the Mont Cenis.
4. *Provençal Alps* west of the Maritime Alps and between the Verdon and the Durance.
5. *Dauphiné Alps* west of the Cottian and Graian Alps and bounded on the west by the Isère, the Drac, and the Col Bayard.

6, 7, 8. *The foothills of Provence, Dauphiné, and Savoy* lying between the previous districts and the valley of the Rhône.

SECOND DIVISION. CENTRAL ALPS

9. *Pennine Alps*, Petit Ferret to the Simplon. Limits: Val d'Aosta, Plain of Piedmont, Lago Maggiore, Toce valley, Simplon Pass, the Rhône, the Dranse.
10. *Lepontine Alps.* The Simplon to the Splugen. Limits: on the south the Passo di S. Jorio; on the east and north the Splugen, the Hinter and Vorder Rhein, the Oberalp and Furka Passes, the Rhône.
11. *Rhaetian Alps.* The Splugen to the Brenner. Limits: on the south the Adda, the Aprica Pass, the Oglio, the Croce Domini Pass, the Chiese, Lago di Ledro, head of Lago di Garda, gap of Loppio; to the east the Adige, the Isacco, the Brenner road: on the north and west the Inn, the Arlberg Pass, the Rhine, and the Hinter Rhein.
12. *The Bernese Alps.* Limits: on the south the Rhône and the Oberalp Pass; on the east the Reuss, Lake of Lucerne; on the north the Brunig Pass, Lakes of Brienz and Thun, Simmenthal, Col de Jaman.
13. *Glarus Alps.* Limits: on the west the Reuss; on the south and east the Vorder Rhein and Rhine; on the north Lake of Wallenstadt and Pragel Pass.

14, 15, 16. *Lombard, Swiss, and Bavarian Foothills.* The first from Lago Maggiore to the Adige, including the Bergamask Alps; the second from the Lake of Geneva to the Lake of Constance including the Säntis summits; the third extending to the lower Inn and Kufstein and including the Zugspitze.

THIRD DIVISION. THE EASTERN ALPS

17. *The Noric Alps.* This includes the Tauern Range (the Central Tyrolese Alps) from the Brenner to the Schober Pass near

Leoben on the east. Its limits on the south are the Pusterthal and the Drave; on the east the R. Lavant; on the north the Ober Enns Thal, the Pinzgau, and the Gerlos Pass.

18. *The Dolomites*, from the Adige and Isargo on the west to the Passo di Monte Croce on the east. The southern limit runs along the Val Sugana to Feltre and Belluno, whence it follows the Piave to its source.
19. *The Carnic Alps*, from the Monte Croce to the Pontebba Pass on the east. Limits in the north the R. Gail and R. Drave.
20. *The Julian Alps*, from the Pontebba Pass to the Passo di Vrata behind Fiume. Limits: on the west the Isonzo, Vissacco, and Timavo; on the east the Save and the plain of Laibach.

Six more Sections or Districts are demarcated in the ranges of foothills that fringe the Eastern Alps. Two of these are furnished by the Karawanken and the Carso. The others may be localized by their names: the Salzburg, Austrian, Styrian, and Venetian Forealps.

English geographers will mark that with certain noteworthy exceptions the "Districts," as here defined, correspond more or less closely with those adopted by Coolidge in the *Encyclopædia Britannica* and in his work on 'The Alps in Nature and History.' Our comments on the list will be confined to cases where the authorities materially differ.

The Commission cuts short the *Maritime Alps* on the west at the Verdon, the ranges between that stream and the Durance being constituted a separate District, the "Provençal Alps." This seems an unobjectionable but hardly called-for addition.

To attach Mont Blanc to the Graian rather than to the Pennine Alps is a novel and at first sight a bold proposal. But, it may be pointed out that the link (or gap) between the Mont Blanc range and the Graians, the Col de la Seigne (8242 feet), is of the same character as that between it and the Pennines, the Petit Ferret (8166 feet). Of course the Little St. Bernard (7064 feet) may be preferred to the Col de la Seigne as the boundary of the Graians. We would venture to suggest that the Mont Blanc range should be allowed the dignity of being counted as a separate District with for its limits the Little St. Bernard and Petit Ferret. We further suggest that the limit between it and the Savoyard Forealps should be drawn not along the Trient and Chamonix valleys, but up the Val d'Illiez and across the low passes leading to Samoens and Sallanches. The Dent du Midi and the Buet are hardly to be reckoned as foothills.

The Glarus Alps of the Commission correspond to the Tödi Range of Coolidge, except that the former makes its northern boundary the Pragel; the latter the Klausen Pass. We prefer the Pragel.

It is when we come to the Rhaetian Alps that we are faced with the most marked discrepancy between our authorities. The "Rhaetian Alps" of the Commission extend from the Hinter Rhein and the Splugen

to the Brenner and the Adige valley. They include, therefore, Coolidge's Albula and Silvretta-Rhatikon groups, the Bernina Alps, the Ortler, Oetzthal, and Stubai groups; and part of his Lombard Alps, the Adamello and Brenta Groups.

This comprehensive medley of incongruous ranges with few common characteristics seems to us inadmissible. The Albula and Silvretta-Rhätikon should, we hold, form one District as the Rhaetian Alps; the Bernina another. The Ortler Stubai and Oetzthal Groups might well be united under the title of The Tyrolese Alps. The Adamello group might include the Brenta. Thus, according to the division between the Central and Eastern Alps already suggested, the Ortler and Adamello would be restored to the Eastern Alps with which they have been (except in the pages of 'The Alpine Guide') generally associated.

In the farther Eastern Alps the Commission carry their Noric Alps to the Schober Pass near Leoben, thus including the Tauern and Lesser Tauern range in a single long District, while Coolidge makes his corresponding District stop at the Radstädter Tauern, and ignores the Lesser Tauern.

The Commission prolongs the Julian Alps to the hills behind Fiume, where a boundary is found in the Passo di Vrata (2832 feet). Others have placed the limit farther north at the Birnbaumer Wald along the ancient road from Laibach to Gorizia and Trieste.

The Map attached to the Report of the Italian Commission draws attention to a singular feature in the face of the Western Alps that fronts the Piedmontese plain. The higher crests of the Alpine range are as a rule protected by an advance guard of lesser heights, the so-called Pre-Alpi, or Forealps. But between Cuneo and Lago Maggiore these outworks fail. Elsewhere, on the western and northern flanks of the Alpine chain they extend from Nice to Vienna; on the southern from Lago Maggiore to Fiume; and on the eastern from Laibach to Graz. The Commission divides them into Districts as follows:

The Provençal Forealps: from the Var to the Durance.
The Dauphiné: from the Durance to the Isère.
The Savoyard: from the Isère to the Rhône.
The Swiss—the Säntis group: from the Lake of Geneva to the Lake of Constance and the Rhine.
The Bavarian: from the Lake of Constance to the Inn.
The Salzburg: from the Inn to the Traun.
The Austrian: from the Traun to Vienna.
The Styrian: from the Semmering to Marburg.
The Karawanken: from Pettau to Villach.

On the south we have the Lombard Forealps from Lago Maggiore to the Adige, the Venetian from the Adige nearly to Trieste, and the Carso or Istrian Peninsula.

This distribution seems as a whole practical and reasonable, though

we could wish that the Säntis Group, Coolidge's " Alps of North Switzerland," had been dealt with as a separate group instead of being merged among the " Sub-alpines." Again we regret that the Bergamask Alps extending from the Lake of Como to the Aprica Pass have not been similarly honoured. Peaks with glaciers surely deserve to be classed as Alps.

It will be seen that, as a whole, we find ourselves largely in accord with the recommendations of the Italian Commission. The chief points of importance on which we suggest reconsideration are, it will have been noted, the line of demarcation between the Central and Eastern Alps and the extension given to the Rhaetian Alps as a District. But it is well to remember that all physical divisions of the Alps are mainly framed for purposes of literary and cartographical convenience, and are more or less imperfect and conventional. We are afraid that short of an International Committee it will be difficult to obtain that uniformity which is so much to be desired. But meantime we welcome the Report of the Italian Commission as an important step towards it.

THE "CRATERS OF THE MOON" IN IDAHO: *A note prepared in co-operation with the Idaho Bureau of Mines and Geology, and published with permission of the Director, United States Geological Survey, by*

DR. HAROLD T. STEARNS

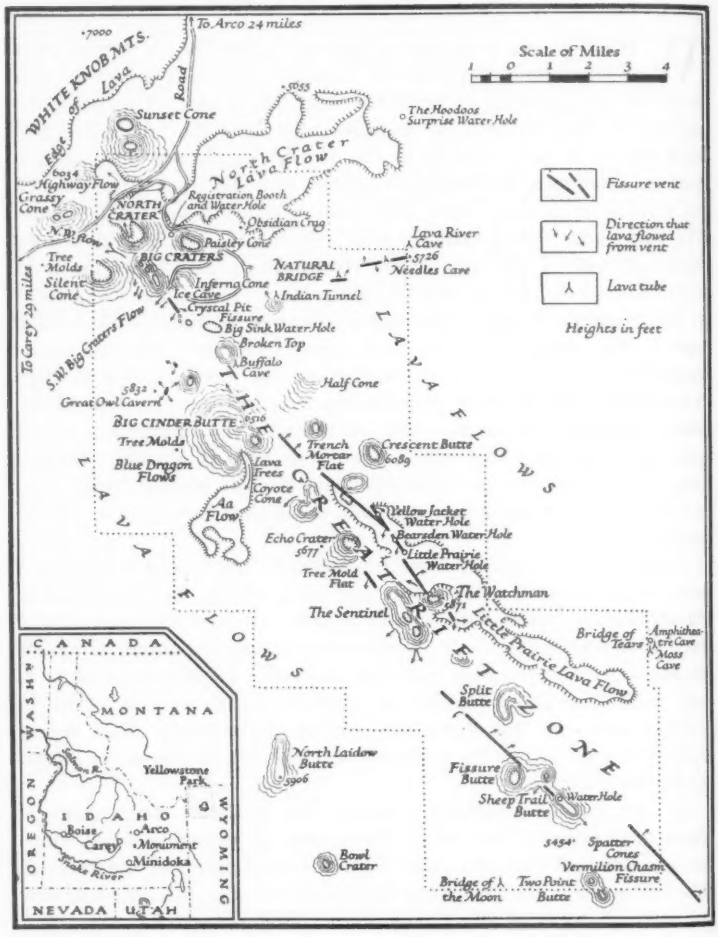
WHEN in recent geological time the glaciers began to melt away from the towering peaks of Idaho floods of lava poured out of a fissure on the south side of the White Knob Mountains. The cooled and weathered products of these eruptions now form the unique volcanic area known as the "Craters of the Moon," which was proclaimed a national monument by President Coolidge on 2 May 1924. It is reached by a drive of 26 miles from Arco south-west along the Idaho Central Highway, and is easily accessible to visitors *en route* for Yellowstone National Park. Upon entering the Monument the road leaves the dusty sage-brush desert for an area of barren black cinders and lava, where it winds among smooth cones and across strips of rough fresh-looking rock. The similarity of the dark craters, and the cold lava nearly destitute of vegetation, to the surface of the moon as seen through a telescope gives to these peculiar features their name. The Monument comprises 39 square miles of the most interesting and recent part of a vast lava-field which covers hundreds of square miles and merges westward into the Columbia Plateau. This plateau covers about 200,000 square miles and is probably the largest lava plateau in the world.

A good view is obtained from the summit of Big Cinder Butte, which rises to an elevation of 6516 feet and ranks among the largest purely basaltic cinder cones of the world. To the east stretches barren black lava with nothing to break its monotony except one group of yellow grass-covered cones which were not inundated by the floods of lava, and which now stand together as a yellow island in a sea of black. Farther east rises Big Butte, the sentinel of the Snake River desert. A little beyond and to the north-east of it are two smaller peaks known as the Twin Buttes.

To the south-east extends a double line of cinder cones, many of them grass-covered, and all of them vents of numerous flows which unite southward into one great field of lava, lonely and uninhabited. Black Top Butte, the farthest in this march of cones, lies approximately 11 miles south-east of Big Cinder Butte. Still farther away are yellow grass-covered cones, and in the distance are barely discernible the snow-covered Portneuf and Bannock mountains. Four miles to the south lies a chaos of cinder crags and jagged lava surrounding a high cinder cone called North Laidlow Butte. Half a mile beyond this cone is Little Laidlow Park, a grass-covered field of ancient lava, appearing pale yellow under the bright desert sun of midday. Farther away on the plain

are low lava domes, and in the far distance beyond the Snake River are pale blue mountains along the Idaho–Utah line.

To the west for about 6 miles the lava has flowed against the southern spur of the White Knob Mountains, filling the valleys as if they were



bays and leaving the ridges like projecting headlands in a black sea. To the north-west there are crater pits, spatter cones, cinder cones, and lava-flows massed along the Great Rift. Many of the cinder cones are brilliant red at noon, but slowly change to purple with sundown. On the tops of many of them are crater pits which are especially beautiful under

the lengthened purple shadows of evening. Beyond these features rise the granite White Knob Mountains covered with grass and streaked with small groves of aspen in the twisted ravines and canyons. Farther northward are the snow-clad Sawtooth Mountains.

Before any lava had appeared in south-eastern Idaho, the White Knob Mountains of granitic rocks, then higher, projected southward into the wide open valley of the ancestral Snake River. All the rivers —Big Lost River, Little Lost River, Birch Creek, and all the other streams adjacent to the area—flowed southward from the mountain canyons and joined the ancient Snake. To-day these rivers sink into the lava plain at the foot of the mountains and find their way underground into the Snake River through numerous crevices and cavities in the lava.

The White Knob Mountains and their foothills were undisturbed except by stream erosion until a fissure called the Great Rift opened on their slope. With this earth-rifting there occurred an eruption that built up a long line of cinder cones, and lava flowed southward and eastward, cooling into thick jagged flows consisting largely of broken blocks. Frozen in some of these lava blocks one can find both large and small fragments of granodiorite that were stoped off from the roof of the lava reservoir and floated upward in the molten lava during the eruption. The lava must have issued at a temperature of about 1200° C., which was too low to remelt the granitic inclusions; hence the white fragments retain all their original characteristics. Numerous eruptions occurred during this epoch, and most of the flows and cones are now buried by later flows. Remnants of these old cones, broken by faulting and weathered down into hoodoo-like pinnacles of cinders and spatter, form the Devil's Orchard, and the field of crags south of Big Cinder Butte. In these crags occurs obsidian, or volcanic glass, which the Indians quarried to make arrow-points and other implements of stone.

For a long time the Great Rift seemed to be healed, but volcanic activity broke out again with renewed vigour, and many of the large cinder cones in the chain that stretches south-east through the centre of the Monument were formed. To this second epoch belong Sunset, Grassy, Silent, Big Cinder, Fissure, Split, and numerous unnamed cones along the Great Rift. Most of their lava-flows have been buried by later flows, but the cones rise as islands above them. The volcanic outbursts were spasmodic but probably followed at short intervals. Often more than one cone was formed during a great eruption, and there is evidence that some of the cones were made by successive eruptions occurring at the same place.

The third and last epoch of eruption followed closely upon the second, and may have been actually closely connected. During this epoch, which is the most recent, all the barren black lavas that are found in the area were emitted. North Crater, visible from the road to Carey, was re-

opened and gave vent to a large billowy lava-flow that moved northward and then eastward. This flow is crossed by the road leading to the Registration Booth. Big Crater gave vent to four flows during this epoch, to the north-east, north-west, and south-east. With the last eruption of Big Crater the line of spatter-cones at the end of the motor road was formed and lava flowed east and west from them. With the subsidence of the lava in the Great Rift following this eruption numerous areas along the rift collapsed, forming a chain of pit craters. Big Sink water-hole is located in one of these pit craters. Big Cinder Butte broke open again and gave vent to a short lava-flow on the north side. Two other outpourings of lava occurred in the area one half-mile north-west of this breach, but the eruptions at these vents did not build cinder cones. Lava also poured out at Indian Tunnel, the Natural Bridge, and at Needles Cave in the area east of Inferno. In the central part of the Monument the old cinder cone called the Watchman opened and lava flowed out quietly from the north-west and the south-west sides. Altogether thirty-five cones and vents and thirty different lava-flows of various epochs are found in the Monument, and many others are probably buried.

No evidence was found of any great explosive eruption such as occurred at Krakatoa in 1883, or at Katmai in 1912. The volcanic outbreaks in the Monument were all of the so-called quiet type and similar to those that occur at intervals at Kilauea and Mauna Loa.

The first type of lava, rhyolite or the iron-poor lava rich in silica, is the common lava of Yellowstone Park which gives the Grand Canyon of the Yellowstone River its magnificent colours. The second type, andesite, contains moderate amounts of both iron and silica, is usually grey in colour, and forms a considerable part of the volcano of Lassen Peak, California. The third type, basalt, rich in iron but poor in silica, covers the Snake River plains, forms the rim rock along the Snake River, and is the only type of lava occurring in the Craters of the Moon.

Two distinct physical types of lava-flows occur here. Pahoehoe, the billowy, ropy type of lava that is filled with caverns, covers about half the area. Its shiny, blue, glassy crust makes some of the flows extremely beautiful in brilliant sunlight. Its wrinkled surface is due to the cooling of a thin crust or scum on the flow while the crust is being pushed forward by the lava below. The numerous caverns that are found in the Craters of the Moon all occur in this lava. As the flow continues the surface and sides solidify and a tube is formed which forks and reforks as the flow moves out over the plain. Thus the lava is conducted without much loss of heat to the advancing margin of the flow, and as the slope of the land is not very steep, only the upper or source ends of the tubes were drained when the lava ceased flowing. Indian Tunnel, Owl Cavern, and Buffalo Cave show lava stalactites formed by the dripping of the lava from the roof. The narrow ledges parallel to the floor of the caverns are the

shore lines of a subsiding river of lava. On the floor the last stream of lava with its ropy and twisted surface is usually visible. When the lava drains away, many portions of the roof fall in or are shaken down by earthquakes accompanying later eruptions. The natural bridges and caverns are shorter or longer roofed-in portions of the tunnel.

The other physical type of lava-flow in the Monument is the rough, bristling, jagged *aa* lava, chemically the same as the *pahoehoe* lava. It appears to owe its origin to the cooling of the lava-flow and the loss of some of the gases. The lava is in a pasty condition while in motion and continually produces this broken, jumbled material by the cooling and breaking of the crust. Some of the fragments are pushed and rolled at the margin of the flow and others are dragged along under the lava. The whole flow resembles slush ice in a river in the spring. *Aa* lava-flows 50 to 100 feet thick are found in the Monument many miles out on the plain.

There are three distinct types of cones in the area: cinder, spatter, and lava cones. The cinder cones, with black loose cindery surfaces and smooth conical profiles, are the heaps of lava froth or spray formed at the eruptions. Big Cinder Butte is the finest example in the area. Spatter cones are formed when the clots of lava hurled out were insufficiently inflated with gas to form cinders and moved so slowly and for so short a distance that they fell as clots in a viscous state and adhered to each other, building up rather steep-sided cones of small height and diameter. The line of spatter cones south-east of the end of the motor road, all less than 50 feet high and 100 feet in diameter, is one of the most perfect in the world. The third type of cone found in the Craters of the Moon is the lava cone or dome. Lava domes consist of solid lava and are broad and flat, and sometimes surmounted by tiny spatter cones less than 10 feet high. These inconspicuous domes are formed by the quiet and continuous welling out of *pahoehoe* lava, and as most of the lava escapes through tubes the cones are not high, often only 30–50 feet. Owl Cavern, Indian Tunnel, and Surprise Cave mark sites of lava domes.

A curious feature found in the Monument are the lava bombs scattered on the cinder and spatter cones. These bombs vary in length from $\frac{1}{2}$ inch to over 13 feet, and in diameter from $\frac{1}{4}$ inch to 3 feet. There are three types—spindle, ribbon, and bread-crust bombs. Spindle bombs, which have ear-like projections on the ends of a football-shaped body, were clots of lava which were hurled through the air with a rotational motion. The best-formed bombs are found close to their source. The ribbon bombs have long tapering twisted ears that project 3 to 10 inches from the ends of the bomb. These long thin strips of lava were broken off by the fall of the projectile and lie scattered on the surface. Some were formed by the pulling apart of two clots of lava travelling at slightly different speeds or in slightly different directions. The long ribbon bombs, 2 to 13 feet in length and a few inches wide, seem to have

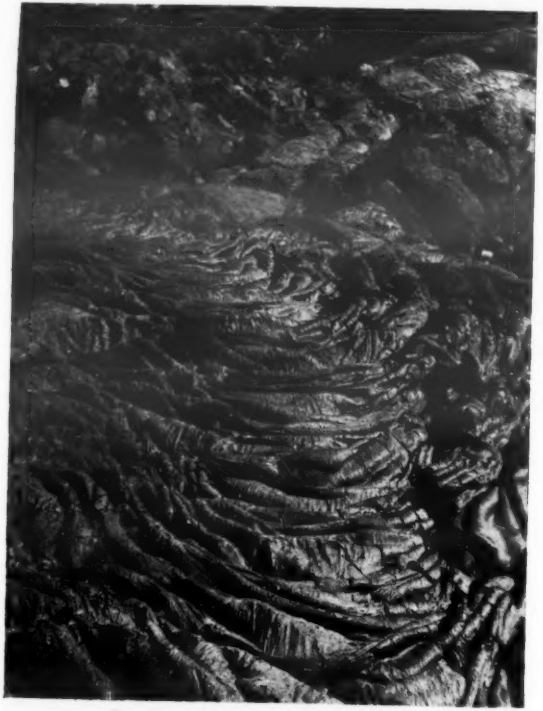
originated in one of two ways. A few are lava clots that fell on the side of a cone, ran down the slipe while still molten, and were later detached by weathering, and the removal of the adjacent cinders. Other ribbon bombs are formed by the throwing out from a spatter or cinder cone of a large clot of very liquid lava that stretches out during its flight and falls on cinders sufficiently loose to prevent its breaking. A third kind of bomb is light and porous and covered with a skin resembling bread crust. They are formed by a clot of lava filled with gas being hurled through the air. During its flight the crust cools and, as the gases expand, the hard skin is cracked open in numerous places.

Tree moulds exist in certain flows in the Craters of the Moon where the lava flowed slowly and at the right temperature into a forest. The moulds vary in diameter from a few inches to 3 feet, and are easily distinguished from other holes in the lava. Many of them are 10 to 20 feet in depth. Molten lava does not completely destroy a tree because a few inches of solid lava crust prevents any great amount of heat from escaping through it, and liquid lava at or near the cooling-point requires very little time to solidify into a poor heat-conducting shell around the tree. While the tree is burning it shrinks away from the surrounding lava, creating an air apace or chamber between the tree and the mould which accelerates the cooling. The process is further aided by the stream from the sap of the tree. There is much less chance of the formation of a mould from a dead tree, for it burns too rapidly. The writer saw in Hawaii two years after the eruption trees only partly buried by lava with their upper portions uncharred and dead leaves clinging to the branches.

Most of the vertical tree moulds do not preserve any charcoal impressions, but where the tops of the trees fell on plastic lava the mould of the charred log and the grain of the wood is sometimes preserved. In places the lava was soft enough or rendered plastic by the steam from the burning wood to flow into the shrinkage cracks in the charred surface of the log, forming a checker pattern easily mistaken for bark impressions. No tree mould showing bark impressions was found in the Monument.

One kind of tree mould, called lava trees, is common on Trench Mortar Flat south-east of Big Cinder Butte. These trees rise 1 to 5 feet above the lava surface, and were formed in the same manner as the tree moulds, except they were in places from which part of the lava-flow could drain away, or else they were buried by spatter from a spatter vent.

Ice-cold water is found even on hot July days in the most unexpected places, its temperature rarely exceeding 2° F. above freezing. Most of the large water-holes occur in depressions in very rough broken lava, where much snow collects in the winter. Some of it sifts down into the crevices between the rocks, and remains sheltered during the summer days. Water during the thaws may drip downward into the crevices, where it is frozen by cold circulating air. Some melts in the summer, but in favoured positions it never entirely melts away, as the lava is a



Surface of pahoehoe lava flow

Hoodoo water hole in loose blocks of aa lava

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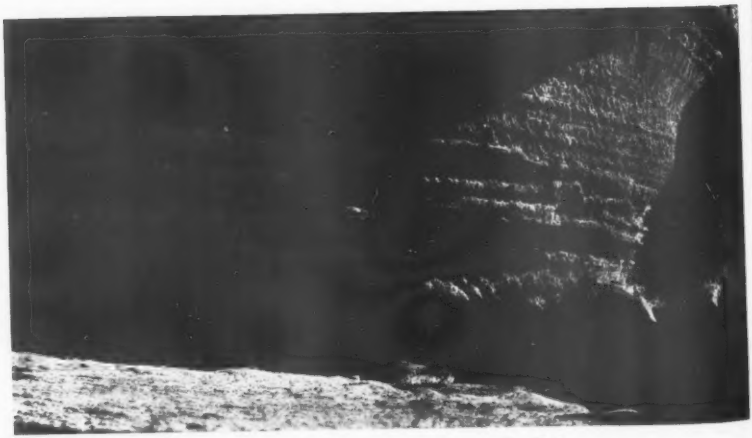
Chain of spatter cones along the Great Rift

Impression of charred log in lava



Ledges marking levels of lava, Buffalo cave

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poor conductor of heat. If one digs down into the loose rock in a water-hole of this type, ice will always be found beneath the water.

Water and ice occur also in the lava caves or tubes where draughts of cold air freeze any water that percolates into them. This occurs about seven months in the year, and during the remaining months there is a gradual wasting away of the ice, but melting proceeds slowly as, even during the summer, the temperature of the interior of the caves does not rise above 40° F. Ice and water are found also in the deep inverted funnel-shaped craters of the spatter cones. The snow accumulates in the crater during the winter and is exposed to the direct rays of the sun for only a short time each day. Thus there results a continually increasing heap of ice which, in the ice cave near the end of the motor road, is about 20 feet thick.

Ice caves do not occur anywhere in the world except where there are freezing temperatures during some part of the year. On the active volcano of Kilauea, Hawaii, where thousands of similar caves occur and where much rain falls, no ice occurs in the caves. The explanation of this is apparent, for no snow falls nor do freezing temperatures occur during the year. Mauna Loa volcano, which rises nearly 14,000 feet above the sea into the snow zone, contains numerous ice caves in and near the crater, and many are found only a stone's throw from a steam vent. The lava in the Craters of the Moon is so fissured that no water is found in it throughout the year except where it lies upon an impermeable body of ice.

Despite the freshness and barrenness of the black lava, the longer one studies them the more one realizes the time that must have elapsed since the last eruption. The absence of the soil on many of the flows is easily accounted for. All the fine dust is blown away or into near-by cracks. This hidden soil accounts for the numerous shrubs and pines that grow in the crevices where no soil is visible. The vegetation has about a four-months' growing season, and is poorly adapted to its environment. The writer found a pine growing in a crack in the Big Crater lava-flow, a flow that appears as black and recent as any in the Monument. This tree has fresh black lava of the Big Crater flow actually touching the trunk 2 feet above the base of the tree, and the tongue of *pahoehoe* in which the tree grows is split open and wedged apart by the roots of the tree. This tree is 33 inches in diameter and has been dead only two or three years, killed by lightning. It is perfectly sound, and shows no burning scars nor any indications of fire. Counting the annular rings of this tree shows that it was four hundred and sixty-one years old. Other larger trees can be found rotting on the lava surface that have been dead at least one hundred years. The lava was certainly extruded before these trees came into existence.

SOME SURVEYS AND MAPS OF THE ELIZABETHAN PERIOD REMAINING IN MANUSCRIPT: *A Paper read in Section E at the Leeds Meeting of the British Association by*

SIR GEORGE FORDHAM

ONE aspect of the early history of British cartography is illustrated by a certain number of surveys and plans which have survived in manuscript to the present time, but of which little notice has been taken.

The object of this paper is to call attention to some part at least of this material, which may be regarded as of historical interest, and of value in the detailed study of the methods of work and of delineation of surface adopted in this early period of the development of our national cartography.

Three Elizabethan surveyors, Christopher Saxton, Philip Symonson, and John Norden, have left plans, of which it seems desirable at least to record the existence, while some of their work, as to which information still exists, has disappeared.

Christopher Saxton

Of this, the first and most famous of our English cartographers, the personal history has never been properly established, though I am accumulating materials out of which I hope, before long, to build up a fairly complete story.

It is enough, for the purpose of this communication, to mention the probable year of his birth as being either about 1544 or 1542, dates supported by depositions made by Saxton himself in 1596 and 1606 respectively (which do not actually agree by about eighteen months), and that he was, no doubt, still alive in 1610, the year in which the will of his brother Thomas (made in 1608) was proved, and in which he is a legatee. He was, in any case, as will be seen later, alive and at work in 1606. Earlier events of his life are recorded in official documents, or otherwise, and may be thus summarized:

1574. First county map published.
1574. March 11. Grant of Grigston Manor, etc., in Suffolk, for 21 years.
1575. January 19. Grant of reversion to Receivership, etc., of the Hospital of St. John of Jerusalem in England.
1575. March 11. "Placart" for survey.
1576. July 10. Letter to Justices, etc., for Survey in Wales.
1577. July 22. Licence to print and publish for 10 years.
1579. Publication of complete series of County Maps.
1579. July 15. Grant of Arms.
1580. July 1. Grant of land in the parish of St. Sepulchre without Newgate, for 60 years, at a ground rent of 3*s.* 4*d.*, with permission to build one or more houses.
circa 1584. Publication of large general map of England and Wales.
[1588. January 15. Death of Thomas Seckford, Saxton's patron.]

One would be inclined to suppose that the completion of his great national work of survey by the publication of the general map of England, and Wales, measuring about 5 feet 8 inches by 4 feet 6 inches, and divided into twenty sheets, followed, some few years later, by the death of his supporter and patron, brought to a close Saxton's public activity, and that thereafter he had little more than what may be called a private practice as a surveyor.

At all events, it appears that he is known during the rest of his life only by the various plans of a local character which he prepared. These are dealt with below, and it is to them that this paper is in part devoted. It will be seen that they cover a period of ten years only, 1596–1606. It is of course possible that other such work may yet be discovered, accounting perhaps for a longer range in time. My researches up to now have not enabled me to amplify the matter further. I have identified six plans as attributable to Saxton, all surveyed and drawn in the above period.

(i) The first, a plan of Manchester, made for the celebrated Dr. Dee, at that time newly appointed Warden of Manchester College, has disappeared. Entries in Dr. Dee's diary, in June and July 1596, give particulars of Saxton's visit to Manchester, and there can be no doubt that the plan was drawn. But, every possible search having been made on more than one occasion without result, this map must be given up as lost or destroyed.

(ii) In the same year Saxton was a witness in proceedings before a Special Commission from the Court of Exchequer appointed to try a question arising between Her Majesty's tenants of the Crown of Haxey and Owston within the Isle of Axholme and Her Majesty's tenants of Misterton in the Duchy of Lancaster, in which it was ordered that a joint plot, or several plots, be taken and made perfectly by scale and measure. Amongst the witnesses were Richard Heley, of Crosby, Lincolnshire, who exhibited and certified a plot, and Christopher Saxton, who also certified a plan. One of these plans, much torn in the upper part, and without title, signature, or date, is annexed to the depositions now preserved in the Public Record Office. It is reproduced, in an exact copy, in 'The Rivers of Axholme, with a History of the Navigable Rivers and Canals of the District,' by George Dunston, London, no date [1909]. 4°. The depositions and records of proceedings are transcribed and printed in full in this volume, but, as far as I have had the text tested in its references to Saxton, with numerous errors. In this portion it should read:

> "Christopher Saxton of Dunningley in the p'ishe of Westardesleye in the Countye of Yorke, Gent., of the age of fiftye twoo yeares or therabouts, sworne & examyned the daye & yeare above saide, deposethe and sayeth that the plott now by him exhibited to the Comissioners & her wth certefied ys accordinge to his skill & knowledge & the informacion of the

meetes, lymittes & bowndes of the Comons & wast grownde in variance betwixte the p'tyes to this suite & also of others mencioned in the order annexed to the Comission ys trew wthout any favour or affection to any of the sayd p'tyes."

This map has a width of 333 mm., and a height, to the extremity of the torn portion, of 475 mm. It is drawn on a scale of 2 inches to the mile, in a plain ruled border, 10 mm. wide. In the border are written: "Occidens," "Meridies," "Oriens." It shows watercourses (blue), plots, partly coloured (in two shades of brownish-yellow), villages, churches, wind-mills, a few roads, with bridges and crosses, and woods and some isolated trees. The names of parishes, enclosures, and other details are written very fully on the map, and the whole is very clearly designed and presented. At the bottom, near the centre, within the border, is a scale of 8 furlongs: "This Scale conteineth one Myle." The authorship of this plan must necessarily be left in doubt; it may be that of either Heley or Saxton.

(iii) A second plan, of much the same character, is found in the Public Record Office, of which the title exists and identifies it with Saxton. This is of the year 1599. The title runs: "A plat of the course of Ludingdē brooke wth the milne goites taken furth of the same from Luddingden Chappell to Luddingden foote, wherein the Confines of Midgeley is colored with yelowe, and the confines of Wareley is colored wth red, made by Christopher Saxton. Anno Dni 1599." This plan measures 270 mm. in width by 475 mm. in height, and is drawn in a plain border 7 mm. wide, in which are written: "North," "South," "East," and "West." On the right-hand side of the plan is a large compass standing on a scale: "This Scale containeth 64 perches," of which 16 perches = 1 inch. The details shown in colour are the rivers and watercourses, some roads and boundaries, houses and other buildings, with names of places, property, and owners.

(iv) Saxton drew also a plan of Dewsbury and the course of the river Calder above the town, dated in 1600, which is now in the Dewsbury Free Library, having been purchased by the Dewsbury Corporation in June 1899, upon the sale of the collections of Sir Thomas Phillipps, of Middle Hill.

A reproduction of about one-half size will be found in *The Yorkshire Archæological Journal* (vol. 21, pt. 4, Leeds, 1911, 8°), illustrating a paper by Mr. S. J. Chadwick on "The Dewsbury Moot Hall." The original should measure about 407 mm. in width by 553 mm. in height. A double-ruled border has written in it: "North," "West," "East," "South"; on the right-hand side of the plan, in a rectangular panel, is the title: "A platt of the Towne of Dewesbury with the course of the River and waies from Maister Birkbye mill, to the ouer; and nether myllnes, of Dewesburie. Made by Christopher Saxton. Anno Domini, 1600," and below this is drawn an open compass standing on a scale,

inscribed: "The scale is 16 pēhes to y Inche." This map gives the houses, river and streams, roads, and a few boundaries, with some of the names written in. It is in the style and colouring of the plans already described.

(v) In the Duchy of Lancaster Depositions in the Record Office are two plans, of 1601 and 1602 respectively, the earlier of which is probably by Saxton, if we are to judge by its close similarity in style and details to the contemporaneous plans signed by him. It measures 244 mm. wide by 401 mm. high. The title is written in a wide-bordered, rectangular panel on the left-hand side of the plan near the top: "A plat of Mychaell Foxcrofte groundes with his house Milnes, goite, or dames. Anno Domini 1601." In the right-hand bottom corner is an open compass standing on a scale of perches, 16 = 1 inch.

(v*a*) In the same set of documents occurs a similar but differently written map, "by John Bell of the city of York. 26 March 1602."

(vi) In 1606, in proceedings relating to water rights, Saxton appears again as an expert witness, and puts in a signed and dated plan, in every respect similar to those above noted. It measures 692 mm. in length and 325 mm. in height, the border being a wide one, = 17 mm. It is drawn on three sheets of paper pasted together. In the left-hand top corner, in a rectangular panel: "A perfect plat of the millnes and Water Courses in question betwixte John Towneley Esquire. plt: and John Parker Gentleman and otheres. Defendantes, made by Christofer Saxton the. 23. of Aprill. An°: Dm̄: 1606." There are several explanatory notes on this plan, and a scale, with open compasses, of 2½ inches to the furlong. The details and colouring do not differ from those of the early plans already described. The record of the proceedings shows that this "plat" was put in by Saxton at the time of his examination before the commissioners, "at Brunley the xxiijth daie of Aprill Annis R. Rs. Jacobi Angliae etc. quarto et Scotie xxxix."

Saxton's depositions are as follows:

> "Christopher Saxton of Dunningley in the Countie of Yorcke gent. aged lxiiij yeres or thereabouts sworne and examyned to the xviijth Interr deposeth and sayeth that he this depon^{t} haith seene and veiwed the water or Brooke of Swinden Runinge betwene the comp^{ts} auncyent mylne and the newe mylne called Mr. Parkers mylne and haith measured the same. And sayeth that he this deponent did not see or pceyve any well springes or Runnells of water w^{ch} doe Come or Rune into the saide water or Brooke of Swindon betwene the saide mylnes but onlie suche as he this deponent haith expressed and sett downe in one Platt by him this deponent made and nowe shewed and delyvered unto the saide Comission^{rs} at the tyme of this his examynacon."

This is the last example of the original work of Christopher Saxton which I have been able to find.

He must have been alive in 1610, when, in the will of Thomas

Saxton, his [elder] brother, made in 1608 and proved in the former year, Christopher, as well as his sons Robert, Christopher, and Thomas, were legatees. In 1626 the will, dated in the same year, of Robert Saxton, is proved, and he gives legacies, amongst others, to Christopher and Thomas. This will is proved by Christopher Saxton, of West Ardesley, "clother," the brother of the deceased (and thus the son of the cartographer mentioned in the will of his uncle Thomas), for the use and benefit of William Saxton, son of the deceased, a minor.

Philip Symonson

While Symonson is known by his large map of Kent of 1596, engraved by Charles Whitwell, to illustrate William Lambarde's edition of this date of 'A Perambulation of Kent,' of which Lambarde himself says: "For my good friend Master Philip Simonson of Rochester, hath lately published some parte of his labor in describing our shyre of Kent, whereby not onely the Townes and Hundreds, with the Hilles and Houses of men of woorthe, are more truely seated: but also the Seacoastes, Rivers, Creekes, Waterings, and Rilles, be more exactly shadowed and traced, than heeretofore, in this, or any other of our lande (that I know) hath been performed," he was also concerned in some private surveys of which traces remain.

It appears that he was appointed Expenditor, Superintendent and Surveyor of the Bridge and the Bridge estates, at Rochester, at Whitsuntide 1592, and that he held these offices until his death on 30 September 1598. During this period he was employed to "plot" several of the estates owned by the Bridge Wardens. Three of these plans are still in the archives in the Bridge Chamber at Rochester; a fourth has failed to survive.

Symonson was Mayor of Rochester for the year 1597–8. During his years of office as Surveyor, accounts of payments made to him occur with regularity, and, after his death, a payment is recorded to Mrs. Symonson for the period between 8 June 1598 and the day of his death. The entry for the year 1594–5, in addition to the record of his annual fee of £10, is as follows: "Paid and allowed to the said Phillip Symons (*sic*) for his paynes in plotting ye Manors of Nashenden and Little Delce in Kent, and for the Manor of East Tilberye in Essex, and for a survey and certificat to be made of the Stadles in the Coppis wooddes and hedge rows of Nashendyn and Delce aforesaid, to be exhibited at the next generall assembly of the Wardens and Assistants. vi^{li} viij^{s} iiij^{d}." There are further entries of the payments for marking and surveying the timber on the above estates, and, in 1595, for "two plots of the Manor of Langdon and the bridge land in Dartford," a payment is allowed of iiij^{s} ij^{d}.

Symonson is to be credited with four plans, and of these three—those of (i) The Manors of Nashenden and Little Delce; (ii) lands in the parish

of Dartford; and (iii) The Manor of Langdon—have survived. The fourth, the "plot" of the Wardens' estate at Tilbury, is not now to be found.

None of these plans are signed, and only one, that of Langdon, is dated (1596), but there is no reason for doubting their attribution to Symonson. They are all drawn on rather thin paper, and are pasted down on vellum sheets. They are in colour, with the same wide, black border, and show the same details of meadows, woods, watercourses, roadways, and buildings, with a few isolated trees, in addition to those distinguishing the woodland areas, and with a scale shown in perches. The acreages are also given in detail in tables in the margin.

While they are not of any general cartographical importance, these plans are of some interest for the illustration of the art and practice in map-making in the Elizabethan period.

(i) The first plan measures 1100 mm. in length by 423 mm. in height, but in these measurements a part of the border is not included, as it has been trimmed off. In the centre of the lower part of the map is a general title: "A Plott & description of the two mannors of Nashenden, and Delce." At the top is, in the right-hand corner: "A Table conteyninge the contents of all the Lands belonginge to the Manno of Litle Delce, both Arable, pasture, and Woodlande, as foloweth, Vz," with a sum total of 236 acres. Again, at the top, towards the left side, is "A Table of the names and contentes of all the parcels of lande belonging to the Mannor of Nashenden . . .," with an acreage of 608.

(ii) The second measures 533 mm. in width by 483 mm. in height, including the border, and accounts for 34 acres only. It is headed: "The Plot of a Tenament and Wharfe with certayne parcels of Pasture, medow, & marsh-lande belonginge to the same; which lye partely together, & partlye dispersed in the parish of Darteforde in the Countye of Kent; being part of the possessions of Rochester Bridge. The names & contentes whereof do folowe, viz.: . . ."

(iii) The third plan, that of the Manor of Langdon, measures 529 mm. wide by 392 mm. high, with the border. The acreage accounted for is, in total, 157, and the title runs: "The Plott & measureme[t] of the Mano[r] of Langdon, lying (for the most part) within the parish of feuersham, and some part thereof, in Graveney, Goodneston, & Hernehyll in the Countye of Kent; being parcell of the proper possessions belonginge to Rochester Bridge. A° 1596."

For these particulars, and those relating to Symonson himself, I am much indebted to both the Hon. Henry Hannen, and Mr. A. A. Arnold, of Rochester, and to the Bridge Clerk, Mr. P. T. Baker, who has been kind enough to allow me to examine the documents in the Bridge Chamber.

John Norden

John Norden has left cartographical work of much importance and of considerable artistic beauty in manuscript. Indeed, it may be said of him that, while he failed to realize his ambitious scheme for a general description and survey of the counties of England, his employment as a surveyor, both by the Crown and by private individuals, and the results of this activity which are still available, give him a more important place than any of his contemporary workers in this section of our sixteenth-century cartography.

Of Norden's life the particulars are fairly well authenticated, in outline at all events, and it is not necessary to restate them here; they have appeared in the Dictionary of National Biography and other publications.* Norden's birth-place, however, is not known, but it appears, from a petition he addressed to Sir Robert Cecil in 1599, that it was in Somerset. The year is believed to be 1548, and he died in 1625 or 1626. The only point of doubt has been one as to the identity of John Norden, the surveyor and cartographer, with John Norden, the writer of devotional books. This controversy, such as it was, has now been disposed of by the investigations of Mr. A. W. Pollard, who has established the unity of this supposed dual existence.†

Taking Norden's plans, as now known, in order of date, the first example (i) is a very large and complete estate-survey, in no less than twenty-eight double-folio sheets, made for Sir Michael Stanhope, in the years 1600 and 1601, of his property lying on the Suffolk coast in the district of Orford. These plans are now bound up in two sections, following a division in the ownership of the original estate; the numbers I. to X. being in Woodbridge, in the office of Mr. Ernest R. Wood, solicitor, and numbers XI. to XXVIII. (number XIII. being, however, missing from the series) in the Sudbourne Estate Office at Chillesford Lodge, near Orford.

I have to thank Mr. Wood and the Hon. Alastair Watson for the facilities which have been accorded to me for examining these plans.

The whole set is of uniform appearance and detail, and displays all the usual elements of the surveys of the period—coast-line and sea, rivers and streams, houses, churches, mills, wooded ground, meadows and field-boundaries, with hedgerow trees, and the names of owners or occupiers—the whole drawn in bright colour on vellum sheets measuring about 528 mm. in height by 722 mm. in width, the double-page maps themselves measuring, approximately, 498 mm. by 692 mm., including the ruled borders. At the beginning of the first section is found

* D.N.B., vol. xli, London, 1895. 8°. W. B. Gerish, 'John Norden, 1548–1626 (?). A Biography, with a Portrait,' etc. Ware, 1903. 8°.

† See 'The Unity of John Norden: Surveyor and Religious Writer.' By Alfred W. Pollard. (*Transactions of the Bibliographical Society—The Library*, New Series, vol. 7, No. 3.) London, 1926. 4°.

the general title of the survey, written in an upright, rectangular panel, surrounded with a wide ornamental border, brightly coloured. It runs as follows :

> " An Ample And Trew Descriptiō and Survey of the Manors, Lordships, Townes, and parishes of Stauerton, Eyke, Bromswall, Wantesden, Chilesforde, Sudburn, Orforde and Duningworth w^t parcell of Tunstall in the Countie of Suff. parcell of y^e landes of the right worship^ll Sir Michaell Stanhop knight of his Ma^ts most ho^l puie (*sic*) cham^b, w^t a distinction of all suche landes of other men as are intermixed w^t, or lye w^t in y^e same. By y^e perambulation, uiew, and dimensuratiō of John Norden accompaned w^t diuers tenants of the same whoe were sworne to giue their best knowledg and directiō in that behalfe begun continued & finished in y^e yeares 1600 & 1601. By warrant of y^e sayde Sir Michaell Stanhope."

On the second page of the first section and the first page of the second is a design in pen and ink of a large compass-circle, with a pair of half-open compasses lying at the bottom, and, across the circle, a band bearing : " *Scala perticarum* 16½ *pedum tota quinq : stadia.*" Below is a " Memorandum that all the plotts lye towards the northe, on the right hande east, on the lefte hande weste, to the bodie Southe," a rather cumbrous way of explaining the orientation. On the back of this page is an explanation of the Tables which follow, in the first section on eleven pages, with one half leaf inserted, and in the second on ten pages, of closely written text, giving full particulars, with acreages, of the various manors and estates.

The maps themselves follow in each case.

The total acreage of the original estate is set out in the following form in the section now at Woodbridge :

> " *Summa generalis* or the universall sume of the Acres of Staverton *cum* Brumswall, Wantesden, Chilsforde, Sudbourne, Orforde, and Dunningworthe Amounteth into
>
> 15,138 ac. 36 perches. vz :
>
> | | | | |
> |---|---|---|---|
> | In | Lease .. .. .. | 6,994 ac. 1 rd. 29 pch. |
> | | Copie .. .. .. | 3,091 ac. 1 rd. 30 pch. |
> | | The lordes handes .. | 1,403 ac. 0 rd. 0 pch. |
> | | Free .. .. .. | 2,732 ac. 0 rd. 0 pch. |
> | | Beache .. .. .. | 640 ac. 0 rd. 0 pch. |
> | | Comon .. .. .. | 278 ac. 0 rd. 0 pch. |
>
> 15,138 ac. 3 rd. 19 pch."

It may be mentioned that a number of these maps give full outlines of the seashore and inlets of the coast between Aldborough, in the north, and a point some distance south of Orford, and have thus a special value in the study of the changes which have taken place in the coastlines in this part of England during the past three centuries.*

* See Vincent B. Redstone, ' Memorials of Old Suffolk.' London, 1908. 8°; and J. A. Steers, ' Orford Ness : A Study in Coastal Physiography ' (*Proceedings of the Geologists' Association*, vol. 37, pt. 3). London, 1926. 8°.

Norden's next survey, in order of date, is (ii) that of the Honour of Windsor, made for James I., of which two copies are known, that made for the King himself, which is in the British Museum (Harleian MSS.), while the second, made for Henry, Prince of Wales, is now at Windsor, having been recently purchased for the Royal Library. The title is: "A DESCRIPTION OF THE HONOR OF WINDSOR, Namelie of the Castle, Foreste, Walkes, Parkes, Rayles, Lodges, Townes Parishes, Hamletts Howses of note, Woodes, Riuers, Rills, Brookes, Bridges Hills, Highwaies, And all other thinges memorable, within, or belonging unto the saide Honor, And the Liberties of the Same Liynge within And extending into the Counties of Barke, Surrey, and Buckingham, Taken and performed by the peram^{bu}latio uiew and deliniation of John Norden In Anno 1607. *Suauis post laborem finis*" On the back of this page are the Royal Arms, followed, on the next page, by the dedication, either to the King or the Prince of Wales. Except for slight differences in the arrangement of the preliminary and explanatory text, the two copies are identical. They make up seventeen plans, or "Tables," as they are denominated, catalogued as follows:

"In Barksh.
- The Castle. table. 1.
- The Foreste with the severall walkes. tab. 2.
- Litle Parke. table. 3.
- Greate Parke. table. 4.
- Moate Parke. table. 5.
- Sunning hill Parke. table. 6.
- Follie John Parke. table. 7.
- Easthamstead Parke. table. 8.
- Swinley Rayles. table. 9.
- Bigshott and Crambourne Rayles. table. 10.

"In Surrey.
- Guldeforde Parke. table. 11.
- Henlie Parke. table. 12.
- Woking Parke. table. 13.
- Byflete Parke. table. 14.
- Bagshott Parke. table. 15."

"In Buck.
- Langley Parke. table. 16.
- Ditton Parke. table. 17."

On the outer first page of each map, and continued on the outer verso, are particulars of the contents. The book, as bound, stands 424 mm. in height, with a width of 285 mm. The maps are double-paged, and in some cases are lengthened by portions folding in. They thus vary in width, while they are uniform in height. At the end of the volume is a table of the "Prime totell of all the Deere by information within the Parkes belonging to the Honor of Windsore," giving the number of red and fallow deer separately, and the areas of the parks. The details in the maps are those found in other plans of this period, but the Castle

and surroundings are drawn in a combination of plan and profile. The whole is brightly coloured, and enriched with gilding.

(iii) A further important work confided to Norden, and of a little later date (1609 to 1616), was a detailed survey of the manors and estates of the Duchy of Cornwall, commenced for Henry, Prince of Wales, and, after his death (6 November 1612), continued and completed for his brother Charles. This survey, bound up in two large quarto volumes, in the original stamped vellum covers, with clasps, in a perfect state of preservation, has quite recently been presented to the Windsor Castle Library by Lord Verulam, in whose library at Gorhambury it has apparently remained since it was presented to Sir Francis Bacon, Sir James Fullerton, "and to the rest of his Highness Worthy Commissioners of Revenues" by Norden.

This survey contains only a few sketch-maps (six in all), and there is nothing to show by whom they were drawn. In any case they are of no cartographical importance. Norden names the four surveyors he employed in this work. The first volume, dedicated to Henry, Prince of Wales, is dated 1611; the second, dedicated to his brother Charles, deals with perambulations undertaken between 1609 and 1616.

These volumes contain a full account, beautifully written, of the manors of the Duchy in Cornwall itself (vol. 1), and of those in the County of Somerset (vol. 2). The plans all relate to parks in Cornwall. The particulars are supported, in most instances, by the findings of a jury, or by other forms of manorial inquiry, establishing the existing conditions of each estate.

In the University Library, Cambridge, are three surveys, in manuscript, dated 1616, 1617, and 1617 respectively, by John Norden, father and son, associated in the earlier case with John Thorpe. There are no maps attached to these surveys, of which the following are the titles:

> (i) "An Abstract out of the generall Survey of the Soke of Kirkto in Lindesey in the Countie of Lincoln with all the Manors, townships, landes and tenements, within or belonging vnto the same being parcell of the inheritance of the righte worthy Charles Prince of Wales Duke of Cornewall and of Yorke and Erle of Chester as belonging vnto his Dukedom of Cornw:"
>
> (ii) "Supervisus Manerii de Blewberie in Com Bark parcellæ terraru et possessionu Charoli Principis Walliæ Ducis Cornubiæ et Eboru et Comitis Cæstriæ," . . .
>
> (iii) "Supervisus Manerii de Shippon in Com Bark parcellæ terraru et possess Charoli Principis Walliæ," etc., as in (ii).

For the Survey of the Honour of Windsor Norden received the fee (large for those days) of £200. His activity was remarkable. As is well known, he commenced, about 1593, a general survey, with maps, of the counties of England and Wales, of which he published the 'Description of Middlesex' in that year, and one of Hertfordshire in

1598. He surveyed other counties (Essex, Northants, Cornwall, Kent, and Surrey), but did not succeed in publishing any further results of his comprehensive scheme.*

He complains of want of support with considerable bitterness, and of the distress in which he finds himself on account of the expenses in which he has been involved by the prosecution of his enterprise. Possibly his difficulties as regards official and financial recognition may have had some connection with the fact that Saxton had completed and published his set of maps of the English and Welsh Counties in 1599, and that Camden's great work, the 'Britannia,' had appeared in 1586, followed by a series of subsequent editions in this country and abroad. It might well have been thought that the expenditure of public money on Norden's venture would, in these circumstances, be superfluous, and this may possibly explain his failure.

Perhaps the most characteristic of Norden's publications is his 'An Intended Guyde For English Travailers,' published quite at the end of his career (1625). This is a series of distance tables for England and Wales and the English counties individually, on the basis of the ingenious triangular scheme invented by him, and which has been made use of ever since, down to our own times, both in this country and on the continent of Europe, and remains a standing and final monument of Norden's inventive skill in his profession.

* Others of his county maps were however published in his lifetime, without descriptions. The Society possesses copies of the Surrey (dated 1594), Sussex (dated 1595), and Hampshire, the last in a later issue, but originally engraved not later than 1603, as shown by the Royal Arms as borne by Queen Elizabeth. It is possible that the Kent was also published, as a copy of it was given by Camden in the 'Britannia' of 1607, no doubt on a reduced scale like the others of Norden's maps used by him. —[Ed. *G.J.*]

THE BARKLY TABLELAND OF NORTH AUSTRALIA:
with special reference to further Pastoral Settlement

W. WYNNE WILLIAMS

WITH the exception of a limited area of coast-line in the north of Queensland the rainfall of Tropical Australia is confined to the period from December to the end of March. The natural fodder grasses dry very rapidly after the cessation of the rain, and the stock subsist for about six months of the year upon dry grasses. The main factor governing the nutritious value of dry fodder is the quantity of rainfall and to a certain extent the manner of its falling. Nature undertakes the process of hay-making, and where the rainfall and the atmospheric conditions are suitable, the result is an edible dry fodder capable of sustaining animal life. In order to achieve this desirable result, matured grass and herbage must not be soaked with rain or dew.

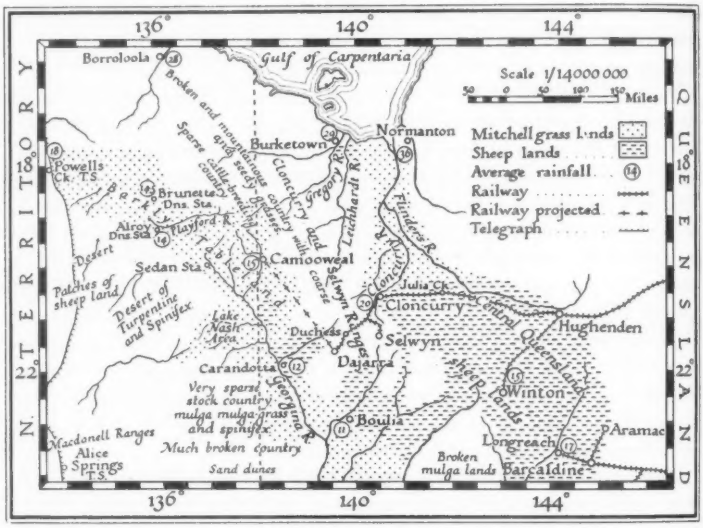
In the heavy rainfall of the tropic coast the grasses have matured and seeded long before the rains have ceased. The succeeding rains and dews followed by heat appear to leach the nourishment from the grasses till there remains little more than an indigestible fibre when the fodders become dry. This applies in a very marked degree to rainfalls of 30 inches per annum and over. In such rainfalls the dry grass is fired as soon as it is sufficiently dry to burn, and a new sward of short green grass results from the moisture still retained in the soil. This second growth of grass retains a fair degree of nourishment, but the influence of dews and a moist atmosphere continue the process of destruction, till at the end of the dry season the stock are invariably poverty-stricken, and the annual mortality in large coastal herds of cattle is estimated at 10 per cent. The cattle tick and other pests which thrive in the moist areas contribute considerably towards this loss.

The rainfall decreases with regularity inland from the tropic coast-line. The Darwin rainfall of 65 inches diminishes to 20 inches about 400 miles inland. The Borroloola rainfall of 28 inches diminishes to 20 inches in a distance of about 100 miles inland towards the Barkly Tableland in the Northern Territory, and the Normanton rainfall of 36 inches diminishes to 20 inches about 200 miles inland at Cloncurry.

The 20-inch isohyet bears a particular significance in the progress of pastoral settlement in Northern Queensland, as it represents approximately the line of demarcation between what is usually recognized as the " Sweet " and the " Sour " country ; south of this line the dry natural fodder is " sweet," that is, it contains sufficient nutrition to maintain cattle in a reasonably strong condition throughout the dry season and a flock of merino sheep with sufficient stamina to ensure a satisfactory increase. The nourishment in the dry fodders increases as the rainfall decreases until the country becomes too sparse in fodder, and thus the carrying capacity is too low to warrant the heavy expense of artificial

watering. Thus the greatest pastoral activity in the Australian tropics is upon heavily grassed land from the 15 to the 20-inch isohyets. The greater part of this area is devoted to merino sheep. The effect of rainfall and the hygrometric state of the atmosphere upon the nutrition of natural dry fodders is true irrespective of the class of fodder, although some grasses are certainly richer than others; and the failure to recognize this influence has led to many misjudgments of pastoral country, because the quality of certain grasses in different latitudes cannot be ascertained by appearance.

Central Queensland contains a large area of rolling prairie well shaded in parts and heavily coated with Mitchell grass (*Astrebla*



The Mitchell Grass Lands of the Barkly Tableland and Central Queensland

pectinata), and it is upon these " Downs," as it is called, that the greatest pastoral activity exists in our tropics. The secret of the success of merino sheep on these downs is erroneously supposed to be due to Mitchell grass, but sheep will thrive better in more arid regions where Mitchell grass does not exist. The secret of the success of the Mitchell grass prairie land is its heavy carrying capacity, the absence of seedy grasses which are destructive to wool, and the tendency of the country to improve, and not to deteriorate, with reasonably heavy stocking.

The Mitchell grass prairie of Central Queensland extends northward to the shores of the Gulf of Carpentaria; and acting on the supposition that all Mitchell grass land was sheep land, merino flocks were placed in various localities along the downs to the sea, only to be withdrawn later

to the south of the 20-inch ishoyet, where they remained for some years. Eventually the expansion of closer settlement forced the wool-grower again to the northward into the cheaper land of the heavier rainfall, and the last decade has witnessed a considerable expansion of wool-growing in the 20-inch rainfall of Cloncurry and for some 50 miles to the northward. At the outset, the stocking of Mitchell grass lands in the 20-inch rainfall was not attended with very satisfactory results. It was argued that the dry fodder was not nutritious, and therefore mating was unsatisfactory; and that the grasses were too harsh and indigestible to nourish the weaned lambs. In the course of a few years of heavy stocking, however, the increase became satisfactory, although the frame of the sheep did not equal in weight those of the lower rainfalls. The wool-grower is still moving northward into the heavier rainfalls, and how far he will proceed with success is a matter of conjecture, because no amount of stocking will sweeten dry fodder to any great degree in a heavy rainfall, and the greater the rainfall the shorter and warmer the wool-growing period.

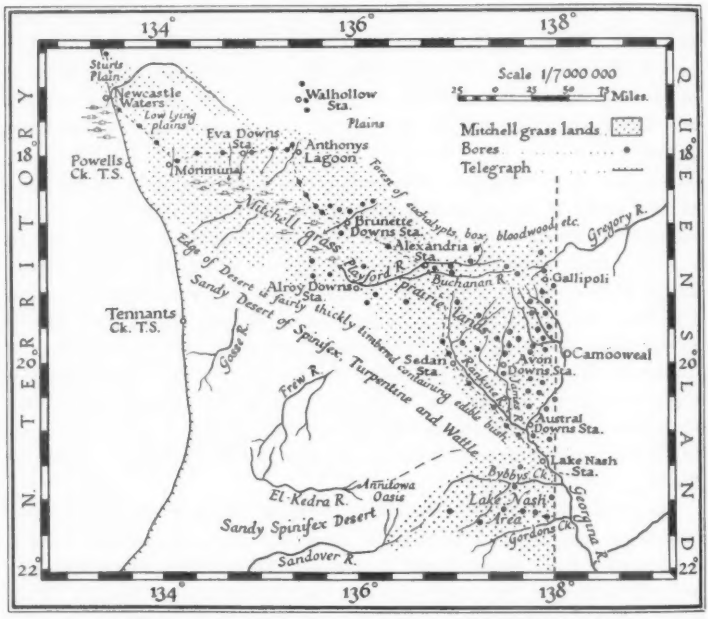
Another factor which is of importance in stock raising is the presence of salt herbs (*Chenopodiaceæ*) among the natural fodder. It is now difficult to determine their original boundary, but they have spread to a great extent over the sheep-stocked prairies of Central Queensland. Large portions of the northern areas, however, show no signs of them. Old-man saltbush (*Atriplex nummularia*) is not found in Central Queensland north of the Tropic of Capricorn, but on the Barkly Tableland it extends as far north as 20° 30′ S., on account of the slight rainfall of that region. This salinity in the natural fodder has an important influence upon the health and growth of stock, so much so that a grazier in a saline belt will dub non-saline country unfit for stock.

The cattle tick is only capable of thriving under moist atmospheric conditions, and the tick quarantine boundary in Northern Queensland is situated a little to the south of the 20-inch rainfall. Sheep men are inclined to declare that where the tick ends sheep country begins. This is not entirely true, because sheep are being depastured with reasonable success within tick-infested country; nevertheless, the absence of the cattle tick seems to denote a hygrometric state of the atmosphere which produces dry fodder with sufficient nutriment successfully to support a flock of merino sheep.

Comparison of the Barkly Tableland with the adjacent Wool-growing Downs of Queensland

The term "Tableland" is often applied to Mitchell grass prairie, distinguishing it from the adjoining timbered red soil and sandy land which bound it often with surprising abruptness. The rolling stretch of open plains reaching from the upper Georgina River in Queensland to

the Telegraph Line in the centre of the Northern Territory is known as the Barkly Tableland. This stretch of Mitchell grass prairie has a length from south-east to north-west of 500 miles, and an average width of about 100 miles within the Northern Territory. Its southern limit is distinctly defined by a fringe of thickly timbered sandy land, which soon gives place to a sandy desert of spinifex with scattered bushes of Wattle (*Acacia*) and Turpentine (*Eucalyptus* ally). Its northern limit is not so well defined, as in various places patches of Mitchell grass plain penetrate into the forest of Eucalyptus. I have disregarded much of this mixed plain country in my estimates because the grasses are inclined



Mitchell Grass and Bores of the Barkly Tableland

to be coarse, and the ground is often badly drained. I wish to aim at a conservative estimate of the wool-growing capacity of the Barkly Tableland, though in so doing I may be excluding a considerable area of land, which may be equal in quality to some of the Mitchell grass country in the extreme northern sheep areas of Queensland.

Although there is a direct connection between the prairies of Queensland and the Barkly Tableland, they are almost separated by the Cloncurry and Selwyn ranges. The soils of the Barkly Tableland are similar in nature to those of the Queensland Downs, and the grasses are similar in appearance. The surface stone of the former is limestone, and of the

latter mainly shale. The northern boundary of the Barkly Tableland is much closer to the Gulf of Carpentaria than the main sheep area of Queensland, but the conditions of rainfall are very different. The northern boundary of the north-western sheep area of Queensland has a rainfall of 20 inches a little over 200 miles inland from the Gulf of Carpentaria, while the Barkly Tableland has a 13·5-inch rainfall in the same latitude and a 15 to 16 inch rainfall at its northern boundary about 150 miles inland from the sea.

To the ordinary traveller who motors through the downs of Queensland, and crosses the barren stretch to the westward of Cloncurry to emerge again on rolling downs upon the Barkly Tableland, no difference is apparent to the eye between the two belts of prairie. The soils appear to be the same, and I have examined the grasses of both belts without detecting any difference. Yet it must be admitted, through the conclusive evidence of the appearance of stock, that there is a very great difference between the northern portion of the Barkly Tableland and the Mitchell grass lands of a similar rainfall in Queensland. There is a lack of nutrition in the dry grasses of the former area which is due in all probability to its proximity to the moist atmosphere of the seaboard of the Gulf of Carpentaria. Some areas of the northern edge of the Barkly Tableland are decidedly sour, and a high degree of nutritiousness does not become evident until the saline belt is reached which is upon the southern edge. The Barkly Tableland contains annual saltbush near the Queensland border in the same latitude as the Cloncurry 20-inch rainfall area where no such salt herbage exists. I have also seen annual saltbush in the desert fringe between Sedan and Alroy. Salt herbs have appeared upon the heavily stocked downs of Alroy, and exist over the southern portion of the downs between Alroy and the south-western corner of the tableland. The Lake Nash area and to the south thereof is particularly saline, and ranks as first-class sheep country. This salinity of herbage which is in evidence over the whole of the southern portion of the Barkly Tableland and only exists in the proved sheep areas of Queensland, leads us to believe that it is desirable sheep land.

The sheep lands of Central Queensland have been stocked for over fifty years, and most of this country contains Mitchell grasses identical with those of the Barkly Tableland, though these through heavy stocking may have become softer in texture. There is ample evidence in certain paddocks upon the Barkly Tableland of the degree to which heavy stocking with cattle has improved the general appearance, quality, and carrying capacity of the grasses, but the effect of stocking virgin country with sheep is much more pronounced than with cattle.

An objection raised by some pastoralists against the Barkly Tableland is the absence of fine curly Mitchell grass (*Astrebla pectinata*, var. *curvifolia*), which is the most favoured of all prairie grasses, and is

confined mainly to the low rainfalls. The Lake Nash area contains short curly Mitchell grass, and to the south of this area where the low rainfall does not permit a rank growth of grass there exists a fine curly Mitchell grass unequalled, in my experience, in Central Queensland. The fine curly Mitchell grass is not by any means the main feature of the sheep lands of Central Queensland, and beyond the fact that " Bull " Mitchell (Var. *triticorde*) is very prevalent on the Barkly Tableland, the grasses appear to be similar on the two prairies.

The main route of travel through the Barkly Tableland undertaken by tourists and others is from Camooweal to Anthony's Lagoon, and thence to Newcastle Waters. On this route a great deal of the poorest land of the Barkly Tableland is traversed. The plains which flank the main road for 50 miles to the eastward of Newcastle Waters are badly drained, and large tracts are covered with moving water during the wet season. Only a portion of the country along the whole route is even lightly stocked, most of it being virgin land, and in some localities the Mitchell grass has a stalky appearance. Nevertheless many pastoralists have been enthusiastic in their praises of these rolling plains, in spite of the fact that the sight of poverty-stricken cattle at Anthony's Lagoon walking to water through a heavy sward of bright rich-looking Mitchell grass must give rise to the suspicion that the dry fodder is lacking in nourishment. Other pastoralists have roundly condemned the Barkly Tableland as a wool-growing area entirely upon the knowledge gained by traversing this northern route. The existence of salt herbs upon the southern borders of the Tableland is realized by very few. These herbs have spread for many miles into the prairies of Queensland, and it appears as if they were spreading upon the southern boundary of the Barkly Tableland. The distance between the southern and northern boundaries is very short, so it is reasonable to assume that salinity will spread by heavy stocking throughout the greater part of the Tableland, and that the grasses will also assume a softer texture. The cattle tick exists on the northern edge of the Barkly Tableland, but does not encroach to the southward except during very wet periods.

The well-known holding of Avon Downs situated on the eastern side of the Barkly Tableland within the Northern Territory, carried a large flock of merino sheep for many years. The difficulties of isolation combined with the fact that the flock did not increase satisfactorily, induced the owners to replace the sheep with cattle during the inflated cattle prices of the war period. This supposed failure of Avon Downs to rear sheep is used by many in condemnation of the Barkly Tableland as a whole as a sheep-raising area ; but the champions of the Tableland declare that the failure of the flock to increase was due to oversized paddocks with insufficient watering-places. That the paddocks were too large and the watering-places too few must be admitted ; nevertheless, had the country been suitable, I think there would have been better

results in spite of those disadvantages. The failure of the flock to increase must be partly attributed to lack of nutrition in the grass.

To ensure safety for the flock against flood the holders of Avon Downs confined their sheep paddocks to an area of hard gravelly ground which was well shaded with Gidyea. After many years of stocking, the Mitchell grass growing thereon still presents a harsh appearance, and remains uneaten by stock while the adjacent soft-soil depressions are eaten bare. Immediately to the south of the Avon sheep paddocks a marked change in the country appears—soft light-coloured soil with every evidence of nutritious grass ; but this country is subject to inundation during heavy rains. There are other portions of Avon Downs which might have produced much better results than the original areas reserved for sheep. The greater part of the Barkly Tableland consists of soft-soil downs, but there are areas of hard country in the north-easterly portion within the Northern Territory, which are not likely to prove successful for sheep-raising until heavy stocking may have improved the texture of the grasses.

The only sheep pastured upon the Barkly Tableland within the Northern Territory at the present time are upon Brunette Downs, where a small flock of about two hundred are shepherded by the aboriginals around the Head Station. Some of these sheep were brought to Brunette from Vandelin Island, and the remainder came from the Federal Government Sheep Station at Mataranka, which is situated within the Darwin area in a 36-inch rainfall. These sheep were in a very deteriorated condition when they were first placed upon the Barkly Tableland at Anthony's Lagoon. They improved rapidly in frame and physique, and were afterwards brought to Brunette, where their improvement became even more pronounced. This small flock of sheep attracts the interest of all visiting sheep experts, who invariably declare that considering the fact that no new blood has been introduced during the past seven years, the result is surprisingly satisfactory. These sheep, although robust and in good condition, do not appear to have increased in number ; this the owners attribute to the carelessness and neglect of the aboriginal shepherds.

A very prominent feature of the Barkly Tableland as a whole is the absence of shade. The Georgina Watershed is well shaded with Gidya (*Acacia georginæ*), and there is an area of 500 square miles of well-shaded land in the vicinity of Brunette Station ; but the watersheds of the Playford and Buchanan Rivers are almost shadeless. A vast sparsely timbered plain, with a width and depth of about 60 miles, stretches from the Rankine River to Alroy. From Anthony's Lagoon westward shade is not plentiful, though here and there the endless monotony is relieved by occasional clumps of Mimosa and small scattered Acacia bushes. Some people are inclined to condemn this open prairie for sheep-raising on account of the scarcity of shade ; but then it would be consistent to

condemn the highly profitable sheep-raising area of Julia Creek between Cloncurry and Hughenden in Queensland, where in many localities the country is as shadeless as the Barkly Tableland. This absence of shade is nevertheless an objectionable feature.

Sheep are being pastured with success upon the Barkly Tableland within Queensland at Carandotta, Muddy Creek, and Bluebush, the last-mentioned place being about 50 miles to the south of Camooweal, on the border fence.

Natural and Artificial Waters

The natural permanent waters of the Barkly Tableland are confined mainly to waterholes in the Georgina River and its tributaries, the Rankine and the James. The Playford and Buchanan Rivers, Brunette and Corella Creeks, supply a limited amount of permanent water; but the greater part of the prairie is drained by small flat channels emptying into a depression in the centre of the Tableland, and they contain no lasting waterholes. The stock upon the Barkly Tableland depend mainly upon artificial supplies. Supplies of good water sufficient to maintain $4\frac{1}{4}$-inch pumps working twenty-four hours per day are struck throughout the Barkly Tableland at depths varying from 150 to 300 feet. There are now approximately 130 sub-artesian bores on the Tableland within the Northern Territory, and the averaging pumping depth is about 220 feet from the surface. All these bores are equipped with 24 or 27-feet windmills or fitted with 6 h.p. steam engines and walking beam pump-heads. The cattle are allowed to remain on the surface waters as long as circumstances permit, and then a minimum of 3000 head are placed upon each bore, where they remain for six months and sometimes longer.

This inexhaustible sub-artesian supply of water under the Barkly Tableland finds an outlet in numerous springs along the coastal fall. The Gregory River, which is a fine perennial stream emptying into the sea near Burketown, probably draws its water from this source. All the waters of the Barkly Tableland are impregnated with lime, but with very few exceptions are quite suitable for human consumption. The brown soil of the prairie lends itself to satisfactory tank building by raising earthen walls by means of scoops to form a square reservoir of capacities of 250,000 to 500,000 gallons of water. Provided the surface of the ground is well ploughed before building the walls upon it, leakage at the base is not common. Couch grass is usually planted upon the walls, which often grows profusely, and binds the soil against erosion.

Drainage within the Northern Territory

Of the 26,000 square miles of possible wool-growing land on the Barkly Tableland within the Northern Territory, about one-third of the area is drained by the Georgina River and its tributaries. This river is a well-defined watercourse, and the drainage of its watershed is good.

The rivers of the remainder of the prairie find no outlet beyond the prairie itself.

Two large watercourses—the Playford and Buchanan rivers—rise near the Queensland border and flow to the westward. Sometimes these rivers possess well-defined channels fringed with Coolibah (*Eucalyptus micranthera*) trees, but in many places the courses of the rivers are only discernible to the practised eye. At the junction of these two rivers the water spreads to the southward over the downs, and at about 20 miles to the north-westward of Alroy the Playford River commences to spread over the surrounding country, helping to fill the great depression which is known as " The Lakes." Two sections of this lake area are known as Lake Sylvester and Lake de Burgh.

While the Playford River forms the lake at the south-east, the creeks flowing from the region of Brunette supply the north-eastern flood area. The width of the flooded country in its eastern area is probably in the region of 50 miles. This flood area then stretches to the north-westward, linking up with a depression to the south of Eva Downs of some 1200 square miles in extent. I crossed to the westward of this depression over 14 miles of flooded country, and found that the flood waters of the lakes connect again with the depression to the south of Monmuna and thence to the desert fringe opposite Powells Creek. Every channel on the northern edge of the prairie to the westward of Brunette flows southward, and every channel to the westward of Alroy on the southern edge flows northward into this great shallow depression, which is at least 150 miles long and in places 50 miles wide.

The lakes retain water for a few months only after the termination of the wet season, so the vast volume of water poured into the centre of the Barkly Tableland during every wet season finds its way rapidly into the bowels of the earth. One fairly large creek pours its flood waters into a limestone cavern some miles to the eastward of the lake.

Not only are the lakes fed by certain well-known and more or less defined flood channels, but the flood waters seem to drain from the sandy forests on the north and the south of the prairie in flat and ill-defined depressions towards the lakes. These water channels are often only discernible by friable, ashy, holey soil, with here and there an occasional shrub of bluebush (*Chenopodium auricomum*), which is indisputable evidence of moving water. Many of these flat drain-channels never reach the lakes, but leave their waters to lie upon the flats to sodden the soil and sour the grasses; nevertheless, there are large areas of rolling downs upon the lake watershed which are free of danger from flood.

With the limited data at our disposal it is impossible to form a true estimate of the area of this flooded depression. If it were flanked on all sides by high country, it would be easy to form an approximate idea; but the quantity of conspicuously high downs to the westward of the

Georgina River appears to be very limited other than in the vicinity of Brunette, which is situated to the north-east of the lakes.

I estimate roughly, however, that at least 5000 square miles of land to the west of Brunette and Alroy are either inundated or too badly drained to carry sheep. The large sparsely timbered plain between the Rankine River and the lakes has an area of about 2500 square miles, and one-third of this is probably inundated or badly drained. Another area of 1500 square miles on the upper reaches of the Playford and Buchanan Rivers is either badly drained or sour. It is necessary, therefore, in attempting to estimate the capacity of the Tableland, to deduct at least 7300 square miles from its total area.

Possible Sheep-carrying Capacity within the Northern Territory

I have attempted to show, by comparing the Barkly Tableland with the sheep areas of tropical Queensland, that climatically and geographically the Barkly Tableland should carry sheep successfully, that is, such areas of it as are not subject to inundation or bad drainage. I do not hesitate to express the opinion that the southern or saline area is suitable to sheep raising, but I have disclosed the fact that over a large portion of the Tableland cattle do not hold their condition on the dry grass as they might be expected to do; and I have been compelled to admit that the poor increase of the flock on Avon Downs is partly attributable to lack of nourishment in the grasses.

In our deductions we must use a comparative basis, and in comparing the Barkly Tableland with Central Queensland, we are to a great extent comparing lightly stocked and virgin country with land of many years of intense stocking. The crowding of a large number of cattle upon a bore during the dry part of the year, as happens on the Barkly Tableland, is not going to achieve the same result in sweetening the grasses as the paddocking of stock within limited areas. The only heavily stocked areas upon the Barkly Tableland are the few paddocks round the station homesteads, and judging from the evidence collected, the improvement in the quality and carrying capacity of the grasses there seems to be very marked. Even on Avon Downs, where the sheep paddocks appear to be on harsh country, the system adopted of large paddocks with limited and badly placed water supplies must have played a large part in the poor increase of the flock.

Theoretically and from practical evidence of the improvement of the grasses due to intense stocking, I think it is safe to assume that all well-drained Mitchell grass land even in the northern part of the Barkly Tableland will become suitable for sheep raising, but much of it will probably need to be stocked with cattle for some years prior to stocking with sheep.

With the present unopened state of the Tableland it is difficult to procure sufficient authentic data to arrive at a reasonable estimate of

the carrying capacity of this great stretch of prairie. The population of the Barkly Tableland within the Northern Territory is probably not more than two hundred souls. The settlement practically ends at Brunette and Alroy. There are few roads on the westward side of the Tableland, and surface water does not exist in the dry part of the year to facilitate inspection.

Deducting the 7300 square miles of flooded and badly drained country as estimated above, 18,700 square miles remain. Assuming that this area will carry one sheep to four acres, which it certainly should do if it is all well-drained and well-grassed land, the carrying capacity of the Barkly Tableland within the Northern Territory may be in the region of 3,000,000 sheep.

Roads, Railways, and Communication

Nearly the whole of the Barkly Tableland is held either by Queensland lessees or by pastoral companies with interests in Queensland, and the main cattle stations of Lake Nash, Austral Downs, Alexandria, Avon Downs, Alroy, and Brunette draw their supplies from that State, using the port of Townsville. The terminus of the Great Northern Railway is Dajarra, which is 600 miles from Townsville, and 140 miles from the Northern Territory border at Lake Nash. Camooweal taps the railway line at Duchess in 160 miles. Numerous motor lorries are in active competition with each other for the Barkly Tableland trade.

The cattle stations mentioned above are connected with excellent natural motor roads, and the main route to Darwin stretches from Brunette to Newcastle Waters, traversing the northern edge of the prairie. These down tracks are closed to motor traffic during rain on account of the stickiness and softness of the soil, and the soil expands during the wet season, causing much unevenness of the ground. A triangular plough is dragged over the roads soon after the wet season, and they are then suitable for motor traffic during the rest of the year.

Other than the police station and store at Anthony's Lagoon there is no settlement in the 240 miles stretch between Brunette and Newcastle Waters. The appearance and the state of this latter property is in direct contrast to the well-improved and artificially watered holdings to the eastward. Newcastle Waters draws its food supplies from Adelaide *viâ* Oodnadatta, and they sometimes take as long as six months to reach the station on camels. It is situated 285 miles from the railhead at Katherine, which is 200 miles inland from Darwin. The route from the Katherine southward is now well served with motor traffic. The railway is now in course of construction from Katherine to Daly Waters, which is 85 miles northward of Newcastle Waters.

Climate

The climate of the Barkly Tableland is bracing and healthy. The summer weather is hot during the day, but usually cool at night. The

winter is bracing, and even the days are sometimes quite cold. At Lake Nash Station, where the thermometer is placed against a wooden wall on a shaded verandah 5 feet from the floor and 7 feet from the unceiled galvanized iron roof, the average maximum reading during June 1925 was 76 degrees and the minimum 46·4 degrees. During November of the same year the average maximum reading was 107·3 degrees and the average minimum 70·9 degrees. February of this year was extraordinarily hot through the failure of the annual rains, the average maximum temperature for the month being 112 degrees and the average minimum 77·6 degrees. The elevation of Camooweal is about 1000 feet above sea-level.

Pastoral Settlement within the Northern Territory

Ample evidence and data are procurable from fifty years of pastoral progress and administration in Central Queensland and elsewhere. The conditions of settlement of the sheep-raising prairie lands of Central Queensland are identical with those of the Barkly Tableland, so in the development of this latter area advantage can be taken of the successes and failures of Queensland closer settlement.

The Barkly Tableland Mitchell grass prairie within the Northern Territory is held by ten lessees holding areas from 8000 to 800 square miles. Two forms of Pastoral Leases are in existence: one is the original lease issued by the South Australian Government before Federation, and the other was issued by the Federal Government in 1912. The greater number of the South Australian leases expire in sixteen years, and they contain no conditions other than those of stocking the land. The 1912 leases expire in the neighbourhood of thirty to thirty-four years hence: the leases do not usually exceed 500 square miles in area, and each lease contains a covenant to water the country. The obligation of the lessee to water the country was not enforced, and very large areas were acquired for speculative purposes only. The holding of excessively large areas has been a serious detriment to the development of the Barkly Tableland, which is carrying to-day not more than 170,000 cattle.*

To improve the situation by inducing the lessees to open portions of their leases for closer settlement, they have been given the opportunity of acquiring new leases of their areas terminating in 1965 conditionally upon a resumption of a quarter of their holdings after the termination of ten years, and a further quarter after the termination of twenty years. The new leases contain no covenants for improving the land, but impose the condition of stocking. The lessees may defeat the process of resumption by sub-dividing on their own account and disposing of the resumable areas within a certain time and as approved by the Honourable Minister for Home and Territories. New leases will be issued for the sub-divided areas. Sub-divisions have already been made, but not as yet disposed of.

* The equivalent roughly of 850,000 sheep.

It is impossible to decide upon economic areas for sub-division at the present time without a decision in regard to railway policy. The nearest railway on the east is 140 miles from the border, and the nearest railway to the western sheep area will be 130 miles away when completed to Daly Waters. Under these conditions, intense pastoral settlement cannot be encouraged. When a definite decision is reached to construct a railway through the Barkly Tableland, linking the Darwin extension with the Queensland railway system, the economic position of the Tableland will be entirely changed and suitable country will be available for wool-growing in areas sufficient for 10,000 sheep. Smaller holdings to accommodate 5000 sheep may become possible, but the ever-increasing cost of production with the additional cost of improving distant lands, where the supply of fencing and building timber is so limited, will necessitate much larger areas of closer settlement than are being adopted in Queensland at the present time. Very small areas lead to overstocking and serious losses in time of drought, while a hand-to-mouth existence with a small number of sheep results in a decline in the quality of the flocks.

As the Land Settlement Policy in Queensland will result in the exclusion of anybody but very small graziers, the Barkly Tableland presents the only outlet at the present time in North Australia for the ambitious selector. First of all, however, evidence must be produced that the *non-saline* area of the Tableland (which represents nearly two-thirds of the total area) is capable of maintaining a flock of merino sheep with a satisfactory increase. If the non-saline prairie will carry sheep in strong condition with only a small increase at the outset, reasonably heavy stocking upon well-watered paddocks is likely to improve the quality of the grasses, and will do so much more successfully than with light stocking, because stock will not eat Mitchell grass while herbage and weeds are in existence. With unlimited scope stock will wander farther and farther afield from water, leaving the Mitchell grass untouched, and at the latter end of the year they are unable to thrive upon the tussocky dried-up grass which has never been eaten down and sweetened.

I know of no belt of country in Tropical Australia which has been the subject of such conflicting views among experienced men as the Barkly Tableland. Criticism is worthless unless based upon comparisons with tropical lands. It is impossible to draw correct conclusions and to make estimates relative to the whole area after a rapid journey along the few main roads. After some years in the eastern side of the Barkly Tableland and two years' study of the remainder I have to admit that my detailed knowledge of it is slight. Concerning the whole of the northern half of the area, although optimistic with regard to a great deal of it, I must bow to the non-committal expression of the cautious pastoralist who believes that the Barkly Tableland remains to be proved as a sheep-raising area.

A LONELY GRAVE IN PATAGONIA:

PROFESSOR WALTHER SCHILLER
OF THE MUSEO DE LA PLATA

ONE hundred years ago, on 20 January 1828, Lieut. Robert H. Sholl, an officer of H.M.S. *Beagle* on her first voyage of surveying, died while the ship was off Puerto San Julian, and was buried on the western shores of the bay, about 3 miles north of the town. The spot is known to-day as "Punta Tumba" from this circumstance. His grave, which lies about 30 feet above high water, was for long marked by a small cairn of yellowish breccia, the local stone, the grave itself being cut in the rock. An iron cross has been set up later: at its foot is a stone tablet, apparently the original monument, upon which the following inscription is cut:

LIEU R. SHOLL
H M S BEAGLE
DIED 20 JAN 1828
N.I. [*or* L.] D. SIYS

The last line was not very legible in 1924. My friend Mr. R. McCormick studied it carefully, but was unable to decipher it. It is probably on account of the aridity of the climate and the deserted nature of the country that the cairn survived so long.

During the last forty years brass tablets have been affixed by the crews of various surveying ships of the Argentine Navy. The first, fixed to the iron cross, which also seems to have been erected by *La Argentina*, bears the inscription:

AQUI YACE EL TENIENTE. R. SHOLL. OFICIAL DE LA BEAGLE FALLECIDO 20. JUNIO (*sic*). 1828. A. SU. MEMORIA . . . LA DOTACION DE LA CORBETA DE GUERRA ARGENTINA "LA ARGENTINA" 8 NOVIEMBRE 1890.

The second inscription cut on the gravestone reads:

A LA MEMORIA DEL TEN^TE R. SHOLL LOS OFICIALES Y TRIPULACIÓN DE LA CORBETA URUGUAY—JUNIO DE 1916.

The third inscription is cut above the second:

A LA MEMORIA DEL TENIENTE SHOLL H.M.S. "BEAGLE" † 1828 LOS OFICIALES Y TRIPULACION DEL BALIZADOR "ALFEREZ MACKINLEY." 31 DE MARZO 1919.

Finally, I am informed by Mr. McCormick that since my visit a fourth tablet has been cut:

A LA MEMORIA DEL TENIENTE SHOLL. LOS TRIPULANTES DEL BUQUE HIDROGRAFO CAÑONERO "PATRIA." 21 DE SEPTIEMBRE DE 1924.

About six years ago an English clergyman placed an iron railing, about 3½ feet high, around the grave.

Little is known of the circumstances of Sholl's death beyond the following extract from the narrative of the expeditions by Capt. P. Parker King and Capt. Robert FitzRoy ('Narrative of the Surveying Voyages of H.M.S. *Adventure* and *Beagle*, 1826–36.' 3 volumes. London: 1839):

> "By the *Beagle's* arrival we were informed of the death of Lieutenant Robert H. Sholl, after an illness of ten days. His remains were interred at Port San Julian, where a tablet was erected to his memory. This excellent young man's death was sincerely regretted by all his friends, and by none more than by me. He was appointed to the expedition, as a midshipman, solely on account of his high character. During our voyage from England he made himself conspicuously useful in saving the cargo of a vessel, which was stranded in Port Praya: and on our arrival at Rio de Janeiro, the Commander-in-Chief appointed him to a vacant lieutenantcy on board the *Beagle*: an appointment which, up to the period of his lamented death, he filled zealously and most creditably."

This account of Sholl's death disposes of the local tradition that he committed suicide after having run the *Beagle* aground. His memory has been sympathetically preserved in several local names.

Besides "Punta Tumba" on the charts, there are, immediately to the north-east, "Punta Sholl," and, 13 miles to the north-north-west of San Julian, "Monte Sholl" (954 feet). On Clarence Island, Magellan Straits, there is also a cove named after him.

This courteous perpetuation of the memory of an officer of the *Beagle* shows that the importance of the work then done is yet realized in the Argentine Republic. For ninety years the surveys of the *Beagle* and *Adventure*, with slight corrections, were the sole charts of this region. Recently, however, charts have been published by the Argentine Government. Of the work of Charles Darwin on the second voyage of the *Beagle* it is unnecessary to write here.

Upon its receipt some months ago Professor Schiller's note was submitted to the Hydrographer, who very kindly caused the original log of the Beagle *to be examined, with the narrative by Captains Parker King and FitzRoy, and sends this additional note:*

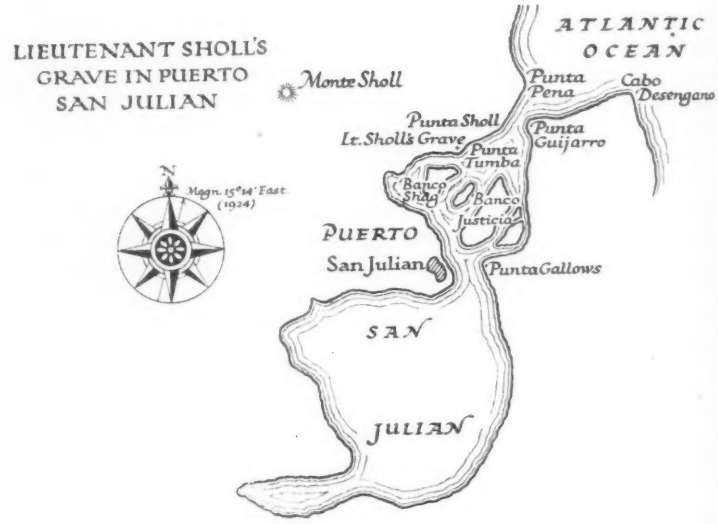
It appears that the sole occasion upon which the *Beagle* touched the ground between leaving England and the date of Sholl's death was on 31 January 1827, when she slid over a rock at the entrance of Port Tamar, near the western end of Magellan Strait. The captain of the *Beagle*, Commander Pringle Stokes, took full responsibility for this:

> "It was nearly dark ere we reached it (the anchorage): and in entering, desirous to keep well up to windward, in order to gain the best anchorage, I went too close to the outer islet, and the ship struck violently on a rocky ledge. However, she did not hang a moment, and was soon anchored in safety" (*Narrative*, vol. 1, p. 73).

The following are the entries in the log of the *Beagle* which refer to Sholl's death:

> "Sunday January 20th 1828. 2.45 [p.m.] Departed this life Lieut. Sholl. "Monday January 21st 1828. 8.40 [a.m.] Capt. went with the Cutter to find a convenient place to inter the body of Deceased. 11.15 The Officers, Marines and Seamen went in the Yaul to inter the body of the Deceased. 4.50 [p.m.] Yaul returned with the Officers. At 6 Captain returned in the Cutter."

The impression that Sholl had committed suicide probably arose from confusion with the death of Commander Pringle Stokes. In August 1828 the latter shot himself in a momentary fit of despondency, arising from "the severe hardships of the cruise, the dreadful weather experienced, and the dangerous situations in which they were so constantly exposed." This occurred at Port Famine, Magellan Strait



REVIEWS

THE PORT OF LONDON YESTERDAY AND TO-DAY. By D. J. OWEN, with a foreword by LORD RITCHIE OF DUNDEE. *London: Harrison & Sons Ltd.* 1927. 11×8 *inches;* viii+106 *pages and illustrations.* 7*s* 6*d*

Though it is not stated, this excellent sketch by the General Manager of the Port of London Authority seems to be put forth under the auspices of that body. The aim of familiarizing Londoners with the most important, but not the most ostentatious, aspect of the City's life is commendable, and is successfully achieved. The early supremacy of London among English ports is remarkable; under the Tudors, it paid half the customs revenue, being followed by Southampton with only 9 per cent. The author does not throw much light upon this rapid rise, perhaps because it is bound up with so many wider questions of English history. A great part in this supremacy was of course played by the "necessary, commodious and practicable" Thames; the first dock, for example, was not built until *c.* 1700. The gradual extension of the port, the relinquishing of control by the City to the Thames Conservancy, followed by the inauguration of the Port of London Authority with its manifold activities, are described naturally in more detail, and the book concludes with a full account of the various docks, the commodities trafficked in, and the latest developments. Comparisons are perhaps odious, but a comparison with other English ports would have been of considerable interest. The book is well illustrated, largely with contemporary pictures, but a general sketch-map might well have been included.

LONDON: BEING A COMPREHENSIVE SURVEY OF THE history, tradition and historical associations of buildings and monuments, arranged under streets in alphabetical order. By GEORGE R. CUNNINGHAM. *London: J. M. Dent & Sons Ltd.* 1927. 9×6 *inches;* xxviii+887 *pages.* 21*s*

The sub-title fairly represents the scope of this compendium, but the variety of its content will be revealed only by a close perusal. The zeal of the author has necessitated his opening the introduction in the "dim geologic past," and then, after a brief history of the City's early history, he presents a useful description of London streets which will assist in making the host of literary references in all periods intelligible, and which shows incidentally some of the difficulties of his own task. The work itself is at once a guide to noteworthy occupants, present and past, of existing houses and of houses since demolished, to the London haunts of characters of fiction, and to the history of famous and ancient buildings. The author appears to be specially interested in theatrical and literary history. The index is very full, over six pages, for example, being given to "Characters in literature." References to living celebrities are included; so that in future years the work should retain its value. The task the London County Council has set itself of fixing tablets upon notable houses suggests the question of where the perhaps invidious line is to be drawn.

THE EARLY YEARS OF THE ORDNANCE SURVEY. By COL. SIR CHARLES CLOSE, F.R.S. Reprinted from the *Royal Engineers' Journal. Chatham: Institute of Royal Engineers* 1926. 10×6 *inches;* 158 *pages; illustrations and maps.* 6*s*

This book is reprinted from a succession of notes which appeared from time to time in the *Royal Engineers' Journal.* The author has been fortunate in securing information of an uncommon and interesting kind in collections of

private letters and papers. Written into the narrative with sympathy and a profound knowledge of the Ordnance Survey, these intimate personal notes give a delightful picture not only of the growth of our national survey but of the characters which have stamped themselves indelibly on method and organization.

Roy, Mudge, Colby, Drummond, Portlock, Reid, and Larcom, all men of rare ability, would have been a formidable band in any society. It is no wonder that the foundations of the Survey were well and truly laid by the combination of their labours.

These personalities have hitherto been somewhat shadowy to most of us soldier-surveyors of to-day. It is then a real privilege to be able to read of the difficulties they overcame, the active part they took in the scientific life of the nation, and the reasons which led them to adopt methods and processes we follow.

The narrative is not, however, confined to the directors and officers of the Survey. The valuable and responsible part played in the early days by those non-commissioned officers who made so many of the field observations of the ground triangulation is given welcome prominence. The history of a recent boundary commission and of our War Surveys shows that the precedent has not been forgotten. A history of the Survey of those days would not be complete without mention of Jesse Ramsden or of Sir George Airy, and they duly appear as humanly and naturally as the rest.

Portraits of Mudge, Drummond, Colby and Portlock, and O'Donovan (to whom the Survey of Ireland owes so much) are given. There is a beautiful extract from a 6-inch of Londonderry, and some other interesting illustrations.

Some day no doubt the history will be carried on, over the great days of Clarke down to the activities of the author of this volume; but it will be fortunate indeed if material of the same personal value is unearthed from the voluminous records of our over-clerical times. H. S. L. W.

DERBYSHIRE. By A. R. HOPE MONCRIEFF, with illustrations by W. B. GARDNER and W. H. COOPER. *London: A. & C. Black Ltd.* 1927. 8×5 *inches;* viii+240 *pages.* 7*s* 6*d*

This handsome volume forms a noteworthy addition to the series of "colour books" whose publication at so modest a cost is a remarkable achievement on the part of this enterprising firm. Some of the illustrations are indeed of a very high standard, particularly those of Mr. Biscombe Gardner, who, when painting a landscape normally somewhat lacking in colour, has wisely dealt mainly with the autumn tints for which it is justly famed. The sketches of scenes in Miller's Dale and Monsal Dale are of singular charm.

It is of interest to note that the "Wonders of the Peak" (which, in the reign of George III. formed the subject of a pantomime on the London stage!), its gloomy caverns, and stalactite vaults, its petrifying springs and the puzzling "swallows" of the Manifold, belong to the fissured limestone skeleton similar to the Italian Carso, the typical example of the "Karst" formation. The tendency to *goitre*, known as the "Derbyshire neck," is a less agreeable instance of kinship with other mountain regions.

Though the "Peak District" of Derbyshire is comparatively unfamiliar to dwellers in the southern half of England, it has a character of its own which fully vindicates its claim to distinction as one of the most picturesque and interesting regions of our country.

The writer of this volume quotes passages from Gray and from Defoe's Gazetteer significant of the popular attitude of their times towards the dis-

tinctive features of the northern part of Derbyshire. The former stigmatizes it as " a country beyond comparison uglier than any other I have ever seen in England, bleak, tedious, barren, and not mountainous enough to please one with its horrors." He seems, moreover, to have found nothing to admire but the palace of Chatsworth, with its " improvements " of natural scenery. The latter turns in disgust from the Peak as " a howling wilderness, and the most wild, desolate, and *abandoned* country in England."

It is to be hoped that in a future edition the author will feel it fitting not only to correct minor errors (not misprints) such as *Markheaton* for Markeaton, *Pentrick* for Pentrich, etc., but also some objectionable phrases in reference to Nonconformist bodies and others. W. W.

DIE STRASSE VON GIBRALTAR. Von Dr. Otto Jessen, mit einem Beitrag von Dr. A. Schulten. *Berlin: Dietrich Reimer* 1927. 9×6 *inches;* xii+283 *pages; illustrations and maps. M.*18

This is the book foreshadowed in the introduction to the monograph on South-West Andalusia (see *G.J.* 67, 354, April 1926), in which, it will be remembered, Dr. Jessen stopped short at the approach to the Straits and postponed also the discussion of the wider tectonic problem raised in the whole area. We are now carried eastwards as far as Gibraltar and Ceuta, and at the same time the scope of treatment is broadened; while the monograph laid the principal stress on the author's geological investigations and on the Tartessos problem, the present book deals on an equal footing, in separate sections, with each of the many aspects, physical and human, under which the Straits may profitably be considered—how far they have affected the distribution of species, whether they have served on the whole as bridge or barrier in human movements, and so on. It is accordingly much more a work for the general student, and the abundance of excellent illustrations, including maps and a large-scale chart, makes its argument much more pleasant to follow.

As the book covers so wide a range the sections naturally vary in value; it is the defect inherent in the *genre* to which this book belongs that some at least of its sections must be based on *ad hoc*, and sometimes hasty, reading; the *genre* is fortunate when one or two are firmly rooted in the author's own life interests. In the former class we hope for perspective and suggestiveness, and a conspicuously successful example is the section which discusses the Straits as the hydrographical clearing-house between Atlantic and Mediterranean; here the whole subject of salinity of ocean currents is vitalized, and there is a most stimulating *résumé* which presents the balance-sheet of the entire water-economy of the Mediterranean. The other class of section is represented (apart from Professor Schulten's exhaustive list of relevant citations from classical writers, convenient for reference but calling for no special comment) by the geological sections based on the author's special studies; from these we expect something different, and here we are disappointed.

In the first place, where Dr. Jessen is speaking from direct observation of an area overlapping that of his previous work, his conclusions are not always consistent with his earlier conclusions and the student is left to reconcile the two as he can. Thus, for the Véjer neighbourhood, the monograph described two movements of post-Plaisancian date: a positive movement of 70–80 m. ending in mid-pleistocene time, and a subsequent negative movement of 20 m. which continued until the beginning of the historical period. In the present work the traces of *four* movements are found over the same stretch of coast, corresponding to the alternating positive and negative movements recorded on the face of the Rock of Gibraltar—incidentally, the Rock is described in a

happy metaphor as a water-gauge (*registrierender Pegel*) registering the closing Mediterranean levels. Now the resultant of the last two movements at Gibraltar is clearly positive, since the shore-lines formed during the second positive remain as terraces after the second negative, so that Dr. Jessen's original two movements are not the resultants of the present four taken in pairs. Are they to be taken as resultants of a one-three or a three-one grouping of the present four, or is he abandoning them altogether? Moreover, since he finds the corresponding coastal terraces at approximately the same level everywhere, tilting cannot be evoked to explain the discrepancy between the original movements (the resultant of which lies between +50 m. and +60 m.) and the present four, of which the net effect is to leave the Plaisancian at an elevation of over 130 m. in the Sierra Carbonera. Clearly this method of working in sections along a coast is attended by great disadvantages which should be minimized to the student by careful co-ordination of the results of successive journeys. The want of this co-ordination spoils for us the author's observations on the coastal strip lying between the La Janda lagoon and the sea, which were required to fill up a gap in the earlier work.

The second disappointment is the treatment of the tectonic problem, and here again the method of study by sectional areas shows up badly. What Dr. Jessen says on the subject of the continuity of the Rif-Jebala and the Baetic systems, and of the origin of the actual breach at the Straits, is excellent so far as it goes, but the real difficulties are the meridional strike of the strata, and the misfit between Europe and Africa, at Gibraltar and Ceuta; in other words, the problem of the Alborán basin is the real tectonic problem of the Straits, and it must be studied as a whole if the Straits are to be rightly understood. Dr. Jessen's eclectic solution—he combines Termier's conception of a *carapace* with the evidence for movements in the mesozoic era adduced by the Spanish geologists—is little more than a categorical statement: he selects his data (erring in this in excellent company, to be sure), but he selects only two of the data (much too few), and even then the logical framework is flimsy. What he says only strengthens the long-standing conviction of the writer that the solution of Gibraltar is in Guelaia and its hinterland, certainly not *vice versa*. In the complex Guelaia zone two great oval-producing systems of fractures are in contact; in the immediate hinterland there are clear evidences of folding movements of at least three widely separated dates; the question of continuity —whether to the east with the Mountains of Kebdana and Oran, or to the north with the Baetic Alpides by Cabo de Gata, or with Sicily and the Apennines by a foundered segment of Alpides lying between east and north—is both more difficult and more important. Here then is the testing-ground of all the Alborán theories.

Here too was the starting-point of Argand's revolutionary theory that the entire Rif–Jebala system is not *in situ* at all, but represents the original westernmost segment of the Baetic Alpides, caught in its present position between Europe and Africa after dislocation from the main chain and subsequent vicissitudes in the eddy off this corner of Europe. Surely Dr. Jessen does not treat his readers fairly in failing to warn them that the most modern school of tectonics interpret the Alborán evidence purely in terms of the various phrases of the Alpine process. Staub treats the Gibraltar evidence cavalierly, of course, but this may prove in the long run a less serious fault than Dr. Jessen's limited outlook.

To sum up, this is a book which should be read—although the marginal criticisms will be many—and which should be kept, because the copious

references make it itself a convenient work of reference. Two outstanding errata call for notice: on p. 27 there is an omission between the seventh and eighth lines, while the lower diagram facing p. 70 must be appealed to for decision between conflicting statements on pp. 69 para. (c) and 75 regarding the seasonal variation in the boundary between the out- and in-flowing currents in the Straits. R. A.

ISLANDS OF THE MEDITERRANEAN. By PAUL WILSTACH. *London: Geoffrey Bles* 1926. 9×6 *inches;* 338 *pages; illustrations and sketch-maps.* 16*s*

The best way to visit the islands of the Mediterranean must be to free oneself from the bondage of shipping firms and order one's own comings and goings in a yacht. But such adventurers must be few. Most have to be contented with cruises that will afford but a few days in the big islands, perhaps only a few hours. For such travellers and for those whose only hope of knowing the Mediterranean is in the library, Mr. Wilstach has written an admirable book. The archæologist may grumble that he ignores the prehistoric remains of Majorca, and the Phœnician remains at Motya in Sicily, and is content to speak of Knossos without considering the difference between Early Minoan II. and Middle Minoan III. The historian may complain that at no time was Corsica under Persian rule, that their masters were not Carthagenians (*sic*), and that elsewhere there are inaccuracies. But the book is not for the specialist: it is for those who have seen a little and want to see more, or have seen nothing and want to know something; and is written by a practised and lively writer and an alert observer, " who sees when he looks."

Beginning at Majorca, we are taken over the ten bigger islands until our guide leaves us at Cyprus, in which island and in Sicily we like him perhaps better than nearer home. But his thumbnail sketches of places and people are always fresh; and the voyages between the islands are never wasted, but full of atmosphere, stimulating to the imagination.

The illustrations are plentiful, mostly from Italian professional photographs, and therefore good; though a few more intimate and less stereotyped scenes would have been welcome. There is also a useful travel note at the end, giving details of ships and their routes. S. E. W.

ITALY FROM END TO END. By H. WARNER ALLEN. *London: Methuen* 1927. 9×6 *inches;* 240 *pages and a map.* 10*s* 6*d*

ITALY TO-DAY. By SIR FRANK FOX. *London: Herbert Jenkins* 1927. 9×6 *inches;* xii+286 *pages and illustrations.* 10*s* 6*d*

The first is by far the best chapter in Mr. Warner Allen's ' Italy from End to End,' though he might have spared us the rather conventional grumbling about the effect of the increase of the ease of locomotion on travel as an art. He has known Italy long, and he knows some parts of it well; moreover he had the advantage of serving on the Italian front, an experience which enabled him to study the Italian in a way in which it is not given to many Englishmen to do, and he has some interesting remarks about his fighting qualities. Into this chapter he has garnered the best of his reminiscences as well as the most original of his observations. Of the other portions the chapter on Tuscany comes first, for clearly it is Tuscany that means Italy to him. The greater part of the chapter on Rome is taken up with an account of the Borgias. Of the rest of Central Italy and of Southern Italy he has no special knowledge, though the fact that he generally visited them on driving tours enables him to see them differently and in some ways more closely than most

tourists. He is fond of getting into conversation with casual acquaintances always of the peasant class, but his reminiscences often tend to be trivial.

Sir Frank Fox turns his back on the past and sets out to give us an account of Fascist Italy, about which he is enthusiastic, with due reservation for the excesses. It is light, discursive, readable, and popular, the kind of book one would expect from the pen of a practised journalist. One remembers the old lady who so loyally stood up for Italy to Mr. Allen some years ago, telling him that she would work out her own redemption—and in her own way. Sir Frank covers the ground easily and pretty thoroughly. He duly had his interview with the Duce, whose career he sketches. He deals with Fascism in connection with Popular Government, Foreign Relations, religion and morals, and the like, but he is at his best on the economic side. There is also a chapter on the Italian colonies. L. C.-M.

GREECE OLD AND NEW. By ASHLEY BROWN. *London: Methuen* 1927. 9×6 *inches;* ix+245 *pages; plates and sketch-map.* 12*s* 6*d*

The material for a book with such a title is almost unlimited, except by the individual tastes of the author, and the likely requirements of future travellers. Each chapter deals with a classical site, its history and archæology. Much of the history, particularly of classical times, is inevitably an oft-told tale, but on several points Mr. Brown adopts an attitude of his own, fortified by an extensive reading of the standard writers. The treatment causes the history to be a little disjointed: the account of the Peloponnesian War, for example, is divided between Athens, Corinth, and Sparta. The author discusses the Spartan mode of life entertainingly and at some length, though a similar treatment of Athenian life did not, apparently, appeal to him. The other quarry, archæological research, he works extensively, and here at least the story is less widely known and there are recent developments to be recorded. His opinion of the modern Greek is not flattering—he does not regard him as in direct descent from classical times—though it must be said that he is aware of the danger of generalization, and has confined himself apparently to city dwellers and politicians. It is a little surprising to find one with the tastes of the writer apparently looking forward to the cosmopolitization of Athens and other cities.

IN A PERSIAN OILFIELD: A STUDY IN SCIENTIFIC AND Industrial Development. By J. W. WILLIAMSON, with a prefatory letter from the EARL OF BALFOUR. *London: Ernest Benn Ltd.* 1927. 9×6 *inches;* 189 *pages;* 24 *plates and a map.* 7*s* 6*d*

To tell the story of an industry is not a new pastime, whether it be done in the guise of a contribution to economics, to human psychology, or purely as commercial propaganda. It is the motive which inspires the pen of many an American author, for instance, where temptation to tell the world about national industrial achievement seems irresistible. In our own country, similar stories have from time to time been told, sometimes with magniloquence, but chiefly with restraint and modesty. The pitfalls facing the unwary in a task of this description are obvious; both in nature and scope, industry as a theme offers golden opportunity to publication of a semi-popular, quasi-technical character which, in the long run, is satisfactory neither to the public nor to the undertaking concerned. In this book the author has not only avoided all the hazards successfully, but he has gone much farther: he has shown us exactly how a story of this kind should be told.

This is the tale of an oilfield—of the life and circumstance of one of the

many regions in the world from which petroleum is won. In some respects it differs little from the narrative of other petroleum fields, but in certain directions it is unique. First of all, the author is not so intent on describing the Persian oilfields as he is on showing, by a quiet and unassuming display of facts, at least one example of the successful application of science to industry. Then, as if to refute the reproach that corporations have no soul, he devotes nearly half the book to the " humanities," as he labels them, and demonstrates exactly what can be and is being done for a small army of workers forming part of an enormous self-contained organization. This is the story of one enterprise, of the finding, producing, and refining of natural mineral oil on a scale and in circumstances which may claim at least the level of achievement of anything accomplished in the New World. The author was invited to visit Persia and collect for himself first-hand information of the varied operations carried out in the winning of oil in that country, and also to study the conditions under which some 30,000 souls are working to provide us with an essential commodity. Apart from the technical data which, save for a few minor slips, are well presented, his descriptions of the human material, medical services, public health, housing and education, and of the social amenities for which the Anglo-Persian Oil Company is responsible, alone make the book worth while.

To those who know little of the inner history of oil production, who want to learn something of the complex scheme of operations with which one organization alone can be concerned, and who wish to prove to themselves that industry guided throughout by science is not merely a stock-in-trade text of the platform speaker, but in at least one case is a potent reality, we commend this little volume as a most instructive and entertaining piece of work, for which every one concerned is entitled to congratulation. H. B. M.

ROMANTIC JAVA AS IT WAS AND IS. By HUBERT S. BANNER. *London: Seeley Service & Co. Ltd.* 1927. 8×5 *inches;* 282 *pages;* 40 *illustrations and a map.* 21*s*

There was room for a book which should give a comprehensive and modern account of Java, its peoples and its resources, and Mr. Banner is to be congratulated on having written it. He has had twelve years' experience of Java, and obviously has made use of his time there to study the island and its inhabitants. His narrative is both readable and authoritative, and although he occasionally deals a shrewd blow at Dutch Colonial administrative methods he never oversteps the limits of fair comment.

He begins by describing the Javanese of the past, and then deals with the people of the up-country villages to-day; there are chapters on Javanese literature, drama, art, music and dancing, and an especially good account of batik work (why does Mr. Banner call it " batick " ?), which the author rightly insists to be a dyeing process, not painting, the layers of wax being laid on the part of surface not intended to come in contact with the dye.

Mr. Banner shows that the glory of Java is in the mountains, and he has a good chapter on volcanoes; although only the size of England, the island contains forty-five, some active, some dormant. He also gives a good description of modern conditions, and makes some thoughtful remarks on the present-day problems of the Dutch colonists: he feels that on the present Governor-General's pledge to take the strongest measures against native extremists hangs the very life and security of Holland's overseas possessions.

If the book has a serious fault it is that it seems to have been put together in rather a haphazard manner: it is odd to find a chapter on " Early Settlers

and their Troubles" immediately after one on "Motoring and Motorists." The photographs are disappointing, and the book was worth something better than a rough sketch-map. O. R.

WITH A CAMERA IN TIGER-LAND. By F. W. CHAMPION. *London: Chatto & Windus* 1927. 10×8 *inches;* xviii+228 *pages;* 73 *illustrations.* 30*s*

Mr. Champion deserves our sincere congratulations. We hope he initiates a new era. In spite of great difficulties—we feel sure in spite of much prejudice—he gives a narrative direct from the jungle, unassociated with any slaughter. For most men in India tigers have a purpose. They exist in order to be shot. Indeed, that is the outlook towards all big game, of which the great achievement of achievements is to get a "record" skin or head. Mr. Champion supplies a splendid corrective. He throws away the rifle and takes up the camera—not indeed a snap-shotting Kodak, but a complicated electrical apparatus with switches, fuses, batteries, and trip-wires. Armed with this, and with endless patience, he confronts tigers in their natural haunts. In Africa a similar thing has been done before; in India the task is incomparably more difficult, and nothing of the kind has ever been attempted.

See the result. We do not exaggerate when we say that Mr. Champion's photographic record is superb. His pictures of tigers are a fine achievement: nothing like them has ever come from India. We wish he had reached the height of his ambition, a picture of a tiger killing its prey. Not only tigers are represented: there are photographs of leopards, deer, hyænas, and others, also some fine representations of elephants. Perhaps the most perfect to our eye is a study of the leopard-cat. The letterpress contains much of interest. Problems connected with these animals are discussed, and the views are those of a first-hand observer who has made his studies at the closest quarters. The last chapter gives photographic information. Had Mr. Champion lived a generation ago the reviewer might not have been amongst those whom he mentions as having attempted and failed.

We hope that this volume means a new development. In India there is too much destruction of wild animals. Mr. Champion points out a better way. It is more difficult, more expensive, more tedious, more dangerous; but it will satisfy to the full the sportsman's instinct. Moreover it will give him trophies of value, incomparatively superior to the often hideous caricatures which he uses to decorate his walls. R. W. G. H.

THE EMBASSY OF SIR THOMAS ROE TO INDIA, 1615-1619. Revised Edition; edited by SIR WILLIAM FOSTER. *Oxford: University Press* 1926. 8×5 *inches;* lxxx+532 *pages: illustrations and map.* 18*s*

Sir William Foster has done well to prepare a new edition of so important an historical incident as Roe's embassy to India as an addition to that published for him in 1899 by the Hakluyt Society, and now long out of print. The new edition is by no means a mere reprint, and in some respects does not supersede the previous edition for those engaged in research. The work of revision has, in fact, been performed with that conscientiousness and intelligence scholars have come to look for in all that appears under Sir William's guidance in matters historical and geographical.

The edition prepared for the Hakluyt Society was meant for the advanced scholars of that body, but this new one is intended for the use of historical students in general, and the changes to be found in it are all made with that object in view. Sir William is to be congratulated on the manner in which he

has set about attaining it and the student in having such a work brought to his hand. R. C. T.

MY JOURNEY TO LHASA. By ALEXANDRA DAVID-NEEL. *London: Wm. Heinemann Ltd.* 1927. 9×6 *inches;* xviii+310 *pages and illustrations.* 21*s*

Madame David-Neel has performed a very courageous and a very difficult feat in travelling to Lhasa from China in disguise. Those who know the terrible cold and the disgusting dirt of Tibet can best appreciate the endurance it must have required to live as she did for months in Tibetan houses of the poorest type and among the lowest classes. The filth of the food would alone be sufficient to deter most travellers.

The geographical results are very meagre, for there is no map attached to the book and no means of knowing exactly what route she took. But her descriptions of the ordinary life of the common folk of Tibet are of real value —of all the more value because she evidently liked and understood them. Her discomfort was acute, as she lived in a hovel in Lhasa among beggars. But they treated her "with simplicity and kindness as one of themselves." And it is surprising to hear from her that these poor wretches enjoyed life even in the depth of winter. "Everybody enjoyed the great luminous blue sky, and the bright life-giving sun, and waves of joy swept through the minds of these unlucky ones devoid of worldly wealth." This is first-hand information of real value. And it is corroborated by her experience of the simple Tibetans throughout her journey.

Her descriptions of monastic life are also of great interest, for she had lived long in monasteries and studied the Tibetan sacred books. All over Tibet are monasteries, and these do at least symbolize a lofty ideal. And if a great number of the occupants fall below that ideal, even these, Madame Neel says, "do maintain a reverence for learning and saintliness."

This being so, it is distressing to hear that hatred of white men is being sown in the remotest corners of Asia where it will thrive and spread. This may be so—or it may not. For one is conscious throughout the book of a strong anti-British sentiment founded on what certainly are not facts. She speaks of the Dalai Lama being under British suzerainty, and of the British not allowing him as much freedom as his Chinese master did. And she seems to think that it is through the British that he refuses permission "to explorers, savants, missionaries, scholars, to all, in fact, except their own agents." And the Tashi Lama is represented as resenting the servitude in which the British Government keeps his country.

But Madame Neel acknowledges that she takes little interest in politics. If she studied them at all she would know that the Dalai Lama is as independent of Great Britain as is the President of the French Republic, and has, and exercises, the right to admit or refuse to admit to Lhasa whom he will. But his decision in this matter is very greatly influenced by the feeling of the powerful monasteries at Lhasa. Against that feeling he dare not go too far.

If Madame Neel had been more fully aware of this she might perhaps have written less disparagingly of the British, who after all have done more than any other people to open Tibet. F. E. Y.

THE BREATH OF THE DESERT. By F. OSSENDOWSKI; English text by L. S. PALEN. *London: George Allen & Unwin Ltd.* 1927. 9×6 *inches;* 279 *pages and* 40 *illustrations.* 16*s*

The author makes wide reading a preparation for travel-writing; a not unworthy preparation for what is really an able, careful, and interesting piece

of pure " book-making." With this he unites a vivid imagination (not necessarily using that word in its depreciatory sense) in the portrayal of the scenery, the people, and the beliefs of two North African countries. Perhaps it is especially true of the desert that we see in it what we take to it; and a stolid English instinct for careful delineation must not make us misjudge the more romantic Slav outlook.

Professor Ossendowski gives us an " account of a journey through Algeria and Tunisia " without any dates, map, or real itinerary to guide us, but with a great deal of picturesque illustration from classic literature, history, scientific treatises, and even guide-books. In such a comparatively well-travelled region his descriptions are not so difficult to verify as in his previous accounts of little-known regions like Tibet, Siberia, and Mongolia, and we must assume that names of his informants, which include such well-known ones as Governor-General Steeg, are not taken in vain, though strangers to the country will need to remember that in dramatic descriptive writing the exceptional is apt to be presented to us as the normal and characteristic. Previous wide reading, moreover, while having its real value as a preparation for travel, is not without its obvious dangers, as when Cervantes teaches the author what to look for in twentieth-century Algiers, and the more naïve observations of less-cultured travellers who come to a new country without preconceptions have often a value of their own which we must not expect here.

Both classes of travellers, however, are apt to reveal one failing which is not absent here: the piling of superlatives one upon another. Hills here are " mountains," buccaneers " all-powerful," and oases " enormous "; while a home-staying reader will too often think he is in the depths of the Sahara when he is actually but just within its fringe.

However, if we are to judge this (as the writer pleaded in the case of a previous book) as " a literary work " rather than as the contribution to geography of a scientific observer (though Nansen, for example, has shown how happily the two can be combined), we should be grateful for a very readable and often amusing, if uncritical, volume which is more suitable as an incentive to travel than helpful or instructive to the actual traveller.

In Bu Saada the author sees a Mzabite merchant, and, though he himself apparently takes the northern route from there to Biskra, he interpolates a vivid and fairly correct account of the Mzab country which is probably entirely due to this encounter. Indeed, the fact that on leaving Bu Saada he describes the point nearest to it (El Hamel) and then only general descriptions of scenery and adventure fill up his chapter till he describes Tolga, equally near to Biskra, reminds the reviewer irresistibly of an Arab guide the latter had in the Aurès who proved to know the first village (Beni Ferah) after leaving the main road and the last (Maafa) before rejoining it, but nothing in between!

It is greatly to the writer's credit that he has nevertheless collected so much that is correct about the religion, superstitions, folk-lore, significance of dances, and the like, though one is inclined to take some of these accounts with reserve when one reads of the ease and readiness with which they were revealed by the natives—one " pirate lay," two pages long, was learnt " on the first evening of my stay "—and then recalls the months spent and repeated visits paid by real students in verifying and correlating the traditions and stories of the country; or again when *en passant* our author " explores all the river-basins with which I came in contact " in so short a space of time " in the vain hope of finding another lonely crocodile "; or yet again when Berbers and Arabs are obviously confused in true tourist fashion.

We are grateful for an index, though in it we have found some wrong references (*e.g.* Timgad, 181). The illustrations, smudgily reproduced, are suggestive of being taken from picture postcards, so unoriginal and familiar are their subjects; and perhaps it is to disprove a previous humorous speculation in this *Journal* as to whether there were such a person as Ossendowski that we are favoured with not one but two almost identical photographs of the author. One picture labelled "Date Caravan, Biskra" is clearly taken 30 miles away in sight of El Kantara.

But, after all, ought we to be so unreasonable as to expect one who rejoices in gorgeous generalizations, poetic reflections, native romances, and florid philosophizing to be tied to such mundane details as these? Let us clear ourselves from such a reproach by referring, with approval of their sentiment, to two brief passages towards the close of the book as illustrations of the author's repeated, well-founded, and usefully emphasized warnings of the dangers that really do exist from both Mussulman and Bolshevist propaganda. They will be found on pp. 151 *ff.* and 263–4. W. C. P.

VANISHED CITIES OF NORTHERN AFRICA. By MRS. STEUART ERSKINE and MAJOR BENTON FLETCHER. *London: Hutchinson & Co Ltd.* 1927. 10×6 *inches;* 284 *pages;* 8 *illustrations in colour and* 32 *half-tone.* 24*s*

This beautifully illustrated volume, in which Mrs. Erskine once again collaborates with Major Fletcher, the artist, is a companion volume to her 'Vanished Cities of Arabia,' published two years ago. The present book covers a great deal more ground and is altogether, both in text and in illustration, a more ambitious work. Starting at Bizerta in Tunis the authors conduct the reader to the leading city-ruins of Tunis and Constantine. There is little in the way of adventure or of modern conditions and nothing of politics, but the past glories of Roman and Arab North Africa are vividly portrayed with a full account of the local history. There are many well-told anecdotes, such as those of St. Salsa of Tipaza, the Berber heroine al Kahira of Thysdrus, and the modern Isabella Eberhardt of es Souf. In all it is a fascinating tale made infinitely more attractive by the excellent drawings and paintings which so well illustrate the text. Who after seeing the pictures would not wish to visit Djemila, Sbeitla, al Djem, and Timgad? The only serious criticism to be made is the inadequacy of the sketch-map and—far more serious in a book so full of names of people and of places—the entire absence of an index.

E. W. G. M.

AN AFRICA FOR AFRICANS. By ARTHUR S. CRIPPS. *London: Longmans* 1927. 9×6 *inches;* xiv+203 *pages, and a sketch-map.* 9*s*

This book is concerned with the future of the native in South Africa, and in particular in Southern Rhodesia, where Mr. Cripps has lived for twenty-five years in close association with the Mashona. The author believes the segregation policy should be adopted: that there should be provided "ample and acceptable areas" which will "secure to Africans such right of self-development, in accordance with the genius of their own race, as a race ought to possess." This is now the accepted doctrine of most of the leaders of European thought in South Africa, and it is the object of the Native Bills introduced by General Hertzog in the Union Parliament.

It is also the declared policy of the Southern Rhodesian Government, and the immediate aim of the author appears to have been to influence the decision on the allocation of unalienated lands in Southern Rhodesia for the

exclusive use of Africans and Europeans respectively. Since Mr. Cripps wrote his book the Bill on this question has been before the Southern Rhodesian legislature, and apparently some of Mr. Cripps' objections to the draft proposal have been met. Roughly 49,000,000 acres are kept for future allocation. Those interested in the details of the subject will find the draft proposals lucidly set forth in what Mr. Cripps calls an appendix, but which is an integral part of his book.

'An Africa for Africans' deserves careful study. There is meaning in the article in the title, for the author is not opposed to the development of European settlement. Although he is against any policy of pin-pricks, that is, undue interference with native methods, he is no advocate of letting the African "stew in his own juice." His ideal is that of trusteeship—as seen in practice, for example, in the Transkei and in Basutoland. Mr. Philip Kerr, Secretary of the Rhodes Trust, in a brief preface urges that when responsibility is assumed by a local legislature that legislature should from the start represent, not Europeans only, but all the races settled in the country. This is also a matter upon which Mr. Cripps lays stress. F. R. C.

UGANDA IN TRANSFORMATION 1876–1926. By the RT REVEREND HERBERT GRESFORD JONES D.D. *London: Church Missionary Society* 1926. 7×5 *inches;* viii.+262 *pages.* 3*s* 6*d*

Dr. Jones describes missionary work in Uganda, covering the whole period from 1877, when the first two missionaries arrived at Mengo, to the present day, when according to statistics there are in the Diocese of Uganda some 165,771 baptized persons, and in the district of Elgon there is something like a mass movement towards Christianity. The author also discusses the labour problems as they exist in Uganda. C. G. S.

HAWKERS AND WALKERS IN EARLY AMERICA. By RICHARDSON WRIGHT. *Philadelphia: J. B. Lippincott Company* 1927. 9×5 *inches;* 318 *pages and illustrations.* 21*s*

In the era succeeding the pioneering stage of domestic self-sufficiency, all wants were met by itinerant traders and practitioners. The author has therefore many diverse characters to draw up, and his catch ranges from the true pedlars of the Colonial period and their more sophisticated brethren of the following century, to preachers, doctors, showmen, actors, and lawyers. He thus throws some interesting light upon a phase of economic adjustment. His style is competent, though occasionally florid. The book is illustrated by contemporary engravings and prints, but remains rather dear at the price.

ECONOMIC AND SOCIAL HISTORY OF THE UNITED STATES. By ISAAC LIPPINCOTT and H. R. TUCKER. *New York: Appleton & Co* 1927. 7×5 *inches;* xxiv+636 *pages; illustrations and maps.* 8*s* 6*d*

This is a text-book designed for Senior School work, and the authors profess the laudable intention of dealing with other than the purely political and economic aspects of their subject; and in particular, of emphasizing cultural and environmental influences. Some attempt indeed is made to do this, *e.g.* in such chapters as that dealing with "The Life of the People" (chapter ix.); and also in some of the questions which appear at the close of each chapter, and are suggested for class work. The fact is, however, that far too much material has been introduced for any of it to be treated other than in a summary fashion.

In these days when the tendency of school practice is to allow more time

for reading and less for "teaching," would it not be better to make our text-books even more completely skeletal summaries; and to encourage the use, for each subject, of a number of "Readers"—not advanced in the sense that they attempted completeness, but works in which the authors might have scope to develop form, atmosphere, and that intimate description which sustains interest?

The modern text-book, of which this is a favourable example, falls between two stools: it is neither an explanatory Date-Chart nor an informed Reader. Then again there is often, as in this instance, a too great subdivision of the subject into water-tight compartments.

The material dealt with in the separate chapters on colonial agriculture, land ownership, manufacture, and commerce, would have been all the better for mixing into an essay, while the treatment of industrial and agricultural production and of transportation is too scrappy to offer the geographer much material for correlation. Ll. R. J.

ROOSEVELT AND THE CARIBBEAN. By HOWARD C. HILL. *Chicago: University Press* 1927. 9×6 *inches;* xi+233 *pages.* $2.50

This is a study of what the author describes as "Rooseveltian Imperialism," and it traces the stages by which the United States, abandoning a policy of isolation, has come to dominate the Caribbean and Central America. The sources are widely drawn, but the most important is the public and private correspondence of Roosevelt now in the Library of Congress. The United States attitude to the various problems seems to have been put fairly and frankly by the editor. There is, of course, little of purely geographical interest.

THE EAST BOLIVIAN ANDES SOUTH OF THE RIO GRANDE OR Guapay. By OSCAR SCHMIEDER. *Univ. of California Publications in Geography Vol 2 no 2. Berkeley, Cal.* 1926. 11×7 *inches;* 125 *pages; illustrations and map*

All who are aware of the great gaps in the map of South America will be interested to read of exploration in the south-eastern Andes of Bolivia. They will be disappointed, but not surprised, to find that Mr. Schmieder has not placed upon the map the greatest physical feature of the region—the courses of the Pilcomayo river and of its tributary the Pilaya. The survey of these Andean valleys undoubtedly calls for a much more ambitious expedition. Moreover, topographical survey does not appear to have been the main purpose of this geographer. He has surveyed a long route-traverse (here printed 1/1,500,000), but he does not tell us how this was done. He gives the positions in latitude and longitude of nine places; but none of these is presumably of his own determining. And here it may be noted that reliable longitude observations are particularly desirable in Southern Bolivia. It would appear that before going to Bolivia Mr. Schmieder had not learned of the existence of all previous surveys of the area, though these are believed now to have been collected in the United States. Had he done so he might have helped the cartographer more than he has done, and incidentally helped himself. The great difficulties of travel in this region, which are described by the author, restricted his three journeys (in 1924–25) to the so-called pack trails; and most of his routes have previously been surveyed after a fashion. But his traverse, if made with care, will at least serve as a check on earlier information.

The author demonstrates in his short text (80 pages) that he made excellent use of his time in observing and recording—often for the first time—important geographical facts; and he has presented a very useful account of the two

distinct regions that make up the eastern Andes in this section. These are the Dissected Puna on the west, and the Front Ranges on the east. The dividing line is about 64° W., on the Rio Grande, and runs roughly S. by W. thence. The two zones are quite distinct in all respects. They are, of course, flanked west and east respectively by the Puna proper (and undissected) and the Gran Chaco. In the paper, each of the geographical aspects is treated separately for the two zones ; and to a clear statement there are added forty-three excellent and well-selected photographs and sketch-maps of the following distributions: structure, land forms, vegetation, communications, while in default of climatic data, one illustrating " land utilization " is interesting. For it shows that in the Dissected Puna zone there is an important climatic change at about 20° N. lat. To the south, the land is poor pasture carrying about three sheep per ha. and with only some 2 per cent. cultivated, and that only with irrigation. North of 20°, on the other hand, crops are watered by rainfall alone, and irrigation is used only for horticulture.

The land-forms of this eastern Puna are well described: features that tell of the formation of a peneplane of great smoothness under a climate still more arid than that prevailing to-day, and of the dissection of the peneplane by the river systems encroaching headward from the east, a result of the second period of Andean orogenic movements and of increased humidity. And some of the details of this stream invasion of the Puna are specially interesting. But perhaps the chief contribution to the subject is the suggestion that some of the valleys have been structurally determined, as in the Rio San Juan del Oro—a northward-flowing tributary of Rio Pilaya. Seven geological profiles of this valley throughout some 30 miles of its course demonstrate that it runs in a narrow syncline of the Puca formation.

In his morphological account of the Front Ranges, the author departs from the theory of Mather—that this part of the Andes bears evidence of peneplanation, and that the river system is of an antecedent character. Schmieder holds that the long meridional scarped ridges are the remains of the structural blocks—mainly of Puca sandstone—originally overthrust towards the east. Furthermore, he believes that the narrow river defiles, which, with the structural furrows, give a trellis-like drainage system, are due to regressive erosion.

The contrast between the Quichua-speaking Puna Indians and the Chiriguanos of the forested Front Ranges is of course referred to. The latter, in accord with the nature of their home, are split up into many petty tribes with small villages. They practise primitive agriculture supplemented by fruit-gathering and fishing. Their place-names record their interest in watercourses, in the fish supply, and in useful trees. The influence of contacts with Europeans is discussed. Though effective occupation of this eastern belt came much later than on the Puna, depopulation has been progressive; and it is fairly clear that these valleys could again support many more inhabitants, were they to be made easier of access. At present only petty trade is carried on, and it is in the hands of Syrians and Armenians, known as " Turcos," who are " pitiless exploiters of the Indians." Since the Great War a new type of pioneer has made his appearance—the Standard Oil Company—perhaps with far-reaching results in the future, if oil prove abundant.

The author quotes a great many previous writings; and it is therefore singular to find no reference to Isaiah Bowman's accounts of the contiguous regions to south and west (especially those in *Bull. Amer. Geog. Soc.*, 1914, and in 'Desert Trails of the Atacama,' 1924), since real observations on human geography are otherwise scanty. Readers of the work before us who

desire to obtain a picture of the Central Andes as a whole and as presented by competent observers, will find material for interesting comparisons between two regions in Bowman's 'Andes of Southern Peru.' Intending travellers in South Bolivia should note carefully Mr. Schmieder's experiences and counsel regarding routes in relation to the seasons.

In conclusion, one may be permitted to express the hope that American geographers will not follow the example of this author in using (*passim*) the English word "landscape" as fully equivalent to the German "Landschaft."

A. G. O.

ARGENTINIEN. By FRANZ KÜHN. *Breslau: Ferdinand Hirt* 1927. 9×7 *inches; Vol* 1 *Text* 256 *pages, vol* 2 204 *pages; illustrations and* 22 *maps. M*42

Many books have appeared descriptive of Argentina, but none hitherto that give us a detailed account of its physical geography on a scientific basis. The gap has now been filled. Franz Kühn has been a University teacher for many years past in Argentina, has travelled far and wide in the Republic, especially in the mountain regions, and brings to his written work the exactness of the trained geologist and geographer and an amazing zeal for detail. This book, written in German, will enhance the reputation he has already made as a contributor in Spanish to Argentine scientific periodicals.

The plan followed in the text volume (to which volume 2 is simply an illustrative appendage) is to subdivide the matter under six main heads, *e.g.* Geology, Climate, etc., and then to subdivide each of these into a number of sections. The result is more than fifty subdivisions, most of which are followed by complete bibliographies, covering books, scientific papers, and periodicals, of the published matter to date relative to the topics discussed. Although this method has the great advantage of enabling the writer to deal exhaustively with every aspect of his subject in turn, it renders repetition of essential facts almost inevitable. This difficulty can be minimized, but not obviated, by a judicious use of a system of cross-references, based upon a detailed treatment of a particular feature in that single section which is most appropriate to receive it. Our author, however, has made little use of this or any similar method of economizing space. Thus on p. 44 we have a vigorous and graphic account of the Puna de Atacama region, the observations in which occupy in a somewhat expanded form the whole of p. 93; and the description of Misiones (p. 25) is repeated, in slightly different words, on p. 127.

So full of facts is this book that observations upon them and deductions from them, which one would often wish to have, seem to get crowded out. Sometimes, indeed, the account degenerates almost into a mere catalogue of facts, as in the section on the Patagonian rivers (pp. 143–9). It is true that the author is dealing with a comparatively unknown country so far as exact geography is concerned, and that he renders a very distinct service in setting forth the raw material for future workers in such a complete and readily accessible manner, all the more so since his wide and detailed knowledge enables him to lay his finger upon numerous points in which previous writers have been in error. Still, one feels on closing the book that by the omission of some of the more obvious facts and by a more scrupulous avoidance of overlapping accounts, space could have been found for deductive reasoning of high scientific value.

On the whole, however, this work is one of outstanding merit. It provides the first authoritative account of the general Geology of Argentina. The style is always vigorous, condensed, and restrained, and sometimes rises to eloquence through skilful description by means of a few bold and essential strokes. The

bibliographies are very full and show an exceedingly wide acquaintance with the work already done in the Argentine field. The 200 odd photographs in the second volume are not only technically very good, but are also admirably chosen and arranged with an eye to their purpose of illustrating the text. The maps have all apparently been specially prepared, present material from new angles with great clearness, and are thoroughly well executed. No serious writer will in the future be able to venture into the geography of Southern South America without taking Kühn's twin volumes into account.

E. W. S.

PEOPLES AND PROBLEMS OF THE PACIFIC. By J. MACMILLAN BROWN. Two volumes. *London: T. Fisher Unwin Ltd.* 1927. 10×6 *inches; Vol* 1 xii+327 *pages; vol* 2 viii+297 *pages; maps and plates.* 50*s*

In his Preface the author states that this book consists in part of articles written for various journals, and the list of those he thanks for permission to reprint articles includes newspapers as well as less ephemeral publications. This prepares us for a journalistic flavour that might otherwise have acted as an irritant. The chapter titles and the numerous headlines emphasize the popular character of the book, and we are not surprised to find that the boundaries between fact and theory are often only faintly indicated, whilst speculation overlaps them both; but there is much that will discourage those in search of rapid knowledge, and the author's headlines are often easier to follow than his text. That "the millennium will be here when human nature is reconstructed or life abolished" may be so true as to be worthy of heavy type, but that "Polynesian came into the Pacific in the Old Stone Age" is a proposition that requires proof rather than emphasis. "Alas, poor Yorick!" the title of chapter vii., is in lighter vein, and the author's frequent references to "Blondism" in the Pacific convey a slight suggestion of topicality. The Condominium in the New Hebrides is tried and found wanting, and the discontent in Samoa, in a chapter headed "The Beach Assembly of the Gods," is dismissed as an anti-prohibition agitation. In a section entitled "The Future of the Pacific" there are gloomy views of possibilities, with the United States and Japan at each other's throats for the mastery of the Pacific.

As is well known, however, Mr. Macmillan Brown is by no means purely a journalist, and he lays before us in this book a great deal of his wide knowledge of the Pacific Islands and their inhabitants. For this we are grateful to him, and he cannot be reproached for the formulation of theories which are opposed to those that are currently held. He ranges far afield for his proofs, and, as befits a revolutionist, he improvises a working constitution as he goes along. He solves the problems of the Pacific with enthusiasm, and if his solutions meet with a certain disregard, this may be due to the fact that versatility is open to suspicion amongst those who plod better than they soar, and in this book, at any rate, the author seems to be very much in the air when he dates the occupation of the Pacific to Palæolithic times.

Notwithstanding all this, the book contains much that is interesting and even important. A large personal equation may tend to the production of writings that will not serve as guides to the young, but it may give colour—not only local, but prismatic—to a work such as this. To dissent is not to condemn, and there may be more truth in Mr. Macmillan Brown's heresies than can be seen by the orthodox eye.

There is a lavish index in each volume, and a vast number of half-tone illustrations.

H. S. H.

TRAVEL IN NEW ZEALAND. By JAMES COWAN. *Christchurch, N.Z.: Whitcombe & Tombs* 1926. 9×5 *inches; Vol* 1 *North Island* 265 *pages; vol* 2 *South Island* 178 *pages; illustrations.* 7*s* 6*d*; 6*s* 6*d*

New Zealand has a rich variety and a compelling quality of natural scenery that has always cast a spell over her children, whether Maori or pakeha: the former have bequeathed to all later comers their emotional experiences in the form of imaginative place-names and pretty nature-legends; the latter, and among them the writer of these volumes, no less impressed in spirit, substitutes the Britisher's activity for the Maori's passivity, explores, makes the land part of himself, and loves it intensely.

Mr. James Cowan enjoys special advantages for the task he has undertaken. He knows his subject at first-hand, having travelled widely especially in the remoter paradises of natural scenery; his style is adequate to his matter; and above all he has that intimate sympathy with the various manifestations of nature he describes that enables him to weave the sweet primitiveness of Maori lore into a harmonious whole with a thoroughly modern outlook. Written primarily for New Zealanders, and outwardly of the first-class guide-book type, this work, just because it is something more than that, should make a wide appeal among those who want to learn further about a remote but fascinating country. Though frankly non-scientific, it nevertheless throws useful side-lights on the more striking aspects of New Zealand geography.

There is little to criticize. The descriptions are sometimes overdone, and a few more detailed maps would have been useful. On the whole, however, author and publishers are to be congratulated on turning out in a distant part of the Empire such a readable, well-printed and illustrated, and at the same time moderately priced work. E. W. S.

UNDER SAIL IN THE FROZEN NORTH. By F. A. WORSLEY with a preface by GRETTIR ALGARSSON. *London: Stanley Paul & Co.* 1927. 9×6 *inches;* 300 *pages; illustrations and maps.* 18*s*

Commander Worsley writes a full and very interesting account of the Arctic expedition organized by Mr. Grettir Algarsson in 1925. The original arrangements contemplated polar flights, either by airship or by aeroplane, but lack of funds resolved the programme into exploration by ship of the little-known region between Spitsbergen and Franz Josef Land. The expedition sailed from Liverpool at the end of June 1925 in the auxiliary brigantine *Island*, formerly *Lady of Avenel*. A point of interest was the arrangement by which leaders and crew, fifteen in all, were volunteers. The narrative rather emphasizes the zest and enthusiasm which prevailed, and forms certainly the most breezy account of recent Arctic travel.

The *Island's* outward route passed along the north coast of Spitsbergen, down Hinlopen Strait, and round Cape Mohn to Cape Leigh Smith. Islands shown on charts off the former cape were found to be non-evident, and have probably been covered by the advancing ice-sheet. Cape Leigh Smith and the east coast of North East Land were corrected for longitude, the real position being about 9 miles west of the charted position. Later in the year similar corrections were applied to Great Island, White Island (here called Gilles Island), and Victoria Island. The main objective was Franz Josef Land, but it was only reached late in August and after many adventures. Heavy pack entailed a southerly course, and while struggling with the ice one of the propeller blades was broken off; from then on the ship had to rely throughout on sail power alone. To have reached Franz Josef Land in these circumstances was

a fine achievement. The return journey was begun on August 31 by a course along the north side of North East Land. Further troubles arose: the *Island* was again beset by ice, held up by persistent fog, and finally exposed to blizzard winds while attempting a farthest north record. With almost constant head winds and a disabled ship progress was slow, and it was not until October 7 that anchor was dropped in Green Harbour, Ice Fiord.

Commander Worsley's performance in the face of all his difficulties confirms his reputation on the *Endurance* and *Quest* expeditions. In the present instance he has not only corrected the charts for longitude, but added largely to our knowledge of the depth and extent of the continental shelf in the extreme north. The ship also came within 60 miles of the land reported by Capt. Gillis in 1707 in 81° 30′ N. A dark appearance was seen a little to the west of the charted position of Gillis Land, and a faint claim is made for its being land. Commander Worsley, knowing the pitfalls, adds however "The appearance, if not land, could only, I think, have been caused by a large area of open water, like a lake in the pack-ice, drifting south." Weighing the matter carefully, there seems little warrant therefore for altering in any way the present assumed position of the still doubtful Gillis Land. J. M. W.

THE CAMBRIDGE ANCIENT HISTORY VOL 6: MACEDON. Edited by J. B. BURY, S. A. COOK and F. E. ADCOCK. *Cambridge: University Press* 1927. 9×6 *inches;* xxiv+648 *pages, and maps.* 30*s*

The central theme of this volume is the rise of Macedonia and the career and conquests of Alexander the Great. The former subject is dealt with by Mr. Pickard-Cambridge, the latter by Mr. Tarn, who in an introductory chapter gives an account of the Persian Empire after the death of Xerxes, and with the aid of a map describes the celebrated retreat of the Ten Thousand. He also, under the title of the Heritage of Alexander, manages to elucidate the whirl of contention that resulted from and followed on the death of Alexander, down to the death of Antigonus in 301 B.C. Events in Greece during the earlier part of the fourth century and the parts played by Sparta, Athens, and Thebes are recounted in three chapters by Mr. Cary. Sicily claims considerable attention. Prof. Bury devotes a chapter to Dionysius of Syracuse, his rise, struggles with Carthage, and extension of his power over Southern Italy. From the date of his death the history of the island is taken up and carried on to 330 B.C. by Mr. Hackforth, who has related its earlier history in previous volumes. In chapter vi. Dr. Hall continues and concludes the history of Ancient Egypt, carrying the narrative down to the last (xxxth) native dynasty, and the coming of Alexander. Alexander founds Alexandria, and with the foundation of that city, as Dr. Hall remarks, the ancient kingdom of Egypt ends, and that of the new Hellenistic Egypt ruled by Greek Pharaohs from the Greek sea city, and in continuous connection with the Mediterranean world, begins. In a Retrospect of 800 years from the priest kings an interesting comparison is made between Egypt and China, with their patient, industrious, conservative peasantry, and recurring invasions of conquering intruders.

There are three subsidiary chapters of considerable interest. Discoursing on the Athenian Philosophical Schools, Mr. Cornford has the opportunity of discussing the philosophy of Socrates, Plato, and Aristotle. Dr. Ernest Barker, in a chapter on Greek Political Thought and Theory in the Fourth Century B.C., presents and criticizes fundamental problems which assume importance whenever systems of government are studied. He reviews the political teachings of Xenophon and Isocrates, Plato and Aristotle, and his lucid and candid exposition of their views on law, property, slavery, women, and education is

worthy the attention of all who concern themselves with political and social problems. The last chapter is a brief account of Greek Art and Architecture in the fourth century by Prof. Beazley and Mr. Robertson. It is somewhat disappointing and is handicapped by the absence of illustrations, which are promised in a second volume of plates shortly to be published. There are eight outline maps; plans of temples; a chronological table; and a bibliography extending to fifty pages, a quarter of which is taken up with the detailed and systematic bibliography on Alexander and his successors by Mr. Tarn, to whom this volume owes so much. E. A. P.

SAIL: THE ROMANCE OF THE CLIPPER SHIPS. Pictured by J. SPURLING, storied by BASIL LUBBOCK. *London: The Blue Peter Publishing Company Ltd.* [1927]. 12×10 *inches;* x+153 *pages; thirty coloured reproductions and a map.* 63*s*

The reason for this most readable—exciting would hardly be too strong a term—work are the pictures by Mr. Spurling. In a brief notice, therefore, their spirited rendering and excellent reproduction must first be emphasized, even at the cost of passing over many interesting details. As Miss C. Fox Smith points out in her Introduction, these vessels were the crown of centuries of human striving with the forces of nature—"the fine flower of the slow growth of maritime progress." That they should have been swept from the seas practically in the moment of their triumph was little short of a tragedy. Too many of Mr. Lubbock's descriptions end in intimating that the vessel was last recorded as a coal hulk at Funchal or elsewhere. It is therefore a matter of congratulation that the *Cutty Sark* should have been preserved from a similar fate. It is pointed out that Mr. Lubbock's descriptions are not intended to serve as a connected history of the clipper ships, but at the same time a little more co-ordination might have been attempted. This is particularly felt when an attempt is made to untangle the various "record" passages quoted throughout. Sometimes, too, technical details are given which may be unintelligible to the general reader. This does not detract in the least, however, from the exciting accounts of the passages themselves. Perhaps the most striking given is that of the tea clippers *Taiping* and *Ariel*, when, in 1866, having crossed the bar of the Min River on the same tide, they docked in London within half an hour of each other. There are other equally close races recorded, and tales also of fires and wrecks. The inclusion of a chart showing the main routes of the clipper ships is very welcome. But the main attraction are Mr. Spurling's pictures, which combine detail and atmosphere with skill.

GRANDE ATLANTE GEOGRAPHICO. Third edition. By MARIO BARATTA and LUIGI VISITIN. *Novara: Istituto Geografico de Agostini* 1927. 16×11 *inches;* 147 *plates*+85 *pages. Lire* 400

ATLANTE UNIVERSALE. *Bergamo: Istituto Italiano d'Arti Grafiche* 1927. 16×11 *inches; 72 plates; index separately. Lire* 300

The first of these, essentially a combination and expansion of two atlases—the 'Atlante della Produzione e dei Commerci,' August 1922, and the 'Grande Atlante Geographico,' November 1922—marks a great advance on its earlier forms. While it presents, almost unaltered, the contents of the former, the regional maps (physico-political) of the latter have been expanded, in number and scale, to produce a work representative of most aspects of geography and of more than national importance. Without introducing disproportion—all European and all other important areas are mapped on scales of at least

1/2·5 M and 1/10 M respectively—larger scales and greater attention are given to areas of unusual interest to Italy: a most valuable feature, for the Atlas provides a more effective representation, not only of Italy and the Italian colonies, but of the whole of temperate and subtropical South America, than is available in other works of similar scope.

On the whole, a high standard of cartographical production is maintained. The relief maps are admirable, combined hachuring and layering achieving an expression of physical features, which is at once bold and reasonably accurate, without obscuring other detail. Incidentally, one of the happiest examples of these is the 1/5 M map of Chile in which those elusive features, the coast range and central valley, have at last received adequate representation on a relatively small scale. Apart from faulty registration, very occasionally in the regional, but rather frequently in the economic, maps, the chief defect of the atlas lies in the method of distributional mapping. Quantitative methods are but rarely used, and where they are, the least significant statistics—percentage of total cropped area occupied by a commodity—are generally mapped. Otherwise producing area alone is indicated, either by colour or by symbols. At their best only broadly indicative of actual area of production, at their worst such maps are positively misleading. It should, however, be noted that in the world maps of the more important commodities, a partial remedy—the employment of two intensities of tint, differentiating between major and minor producing areas—is employed, and that these maps contain a novel and useful representation of direction and relative volume of crop movement on the ocean routes by means of varying breadth of lines. Peculiar to the atlas, and therefore of considerable value, are certain maps, among which those of the agricultural zones in the Italian Colonies and the quantitative map of hydro-electric developments in Italy are most interesting.

In the nature of the case, the text accompanying the maps must be brief. Useful, because of the fairly recent statistics—generally 1925 figures—it rarely goes beyond description and elaboration of the maps.

Whether examined from the standpoint of scope and character, or from that of cartographical production, the second atlas can only be regarded as sadly behind the times.

In the first place, more than half consists of descriptive text, which, in spite of accuracy and conciseness, fails to compensate for neglect of mapping. Further, that neglect is most marked precisely where scanty, condensed, verbal description must be least effective—in the representation of physical features. Fifty-seven of the seventy-two coloured plates are devoted to political maps in which it is true there is some attempt to denote relief. However, the frankly conventionalized hachuring employed, together with the muddling effect of broad and heavily coloured political boundaries, renders this ineffective, and one looks in vain to the eight contoured and layered physical maps—six of which are on scales smaller than 1/15 M—for any remedy.

Compensating to some extent this serious over-attention to political geography are the many black-and-white illustrations of the text, but the small scales adopted, the difficulty of carrying conviction by means of differentiating symbols in one colour, and in some cases the over-generalizations—seen particularly in the climatic charts—detract from their value.

The text is more modern than the cartography, and although it contains little more than elementary observations, is nevertheless valuable, generally for its statistical tabulation and particularly for its notes on the provincial geography of Italy. H. A. M.

A NEW VOYAGE ROUND THE WORLD. By WILLIAM DAMPIER, with an introduction by SIR ALBERT GRAY, K.C.B. *London: The Argonaut Press* 1927. 11×8 *inches;* xxxvii+376 *pages; illustrations and maps.* 30*s*

In the whole history of exploration there are very few figures more singular than Dampier. Temperamentally a Quaker, by inclination a naturalist, a botanist, an ethnologist, and an explorer, rivalling the Elephant's Child in his "'satiable curtiosity," Fate bade him pass the greater portion of his life either in the laborious and ill-paid drudgery of the pirate's life (a profession for which he had little aptitude and less inclination) or in the equally hazardous and still less remunerative occupation of endeavouring to combine exploration and privateering while in command of various ill-found and unsuitable vessels manned, for the most part, by the scum of the earth. His career suggests several curious analogies. Like Hamlet, he was better fitted for any other part on life's stage than that of the man of action for which circumstances cast him: he could say, with Paracelsus:

> "We should look for knowledge where we may expect to find it, and why should a man be despised who goes in search of it? Those who remain at home may grow richer, and live more comfortably, than those who wander—but I desire neither to live comfortably nor to grow rich:"

and, less strikingly but no less certainly than Emin Pasha, he illustrated the inherent weakness and indecision of the detached, scientific temperament when in conflict with men of action. In his own day Dampier was judged chiefly on his record as a leader of men—and as such he was found wanting: it was reserved for later generations to redress the balance, and to acclaim him for his real worth—a born scientist and traveller, a worthy member of a long line running from Ibn Batuta and Marco Polo, through Thevenot, to Darwin and others of our own age.

In the intervals of his roving life, Dampier found time to write and publish three great books: the 'New Voyage round the World,' the 'Voyages and Discoveries,' and the 'Voyage to New Holland.' The present work is a reprint of the first of these—Dampier's wonderful journal of what must surely be one of the slowest circumnavigations on record. Begun in the spring of 1679 with a trip to the West Indies, it soon became transformed into a spell of eight and a half years of promiscuous buccaneering and piracy, comprising among other incidents the sack of several fortified towns, a mutiny, a passage on foot across the isthmus of Panama, and numerous pitched battles by sea and land; and diversified, whenever Dampier's professional avocations permitted, by the most diligent and copious scientific observations upon many branches of natural knowledge. Passing from ship to ship, going wherever his trade led him, Dampier sickened at last of scenes and surroundings and with rare decision and courage he escaped from his ship by night in a frail canoe. He won his way safely to Benculen, and eventually sailed into the Downs in September 1691, "with no more marketable commodities than a tattoed native." But he had something more enduring: he had his journal—and so have we.

This edition of the 'New Voyage round the World' is in every way worthy of the memory of a very remarkable man. The editor, Mr. N. M. Penzer, a Fellow of the Society, has done his work in a most scholarly and able manner. Witness the following passage from the Preface:

> "At the very outset of my researches I was faced with a mass of contradictory and incorrect references—the work of past cataloguers for

whom the intricacies of the numerous issues and editions had proved too complicated. Even now I cannot state with absolute certainty that the results of my work have produced a bibliography of Dampier's works complete in every detail. At the same time, it is gratifying to know that the Library of the British Museum has accepted it, and has found it necessary to revise *in toto* the pages of the General Catalogue containing the Dampier entries."

Sir Albert Gray, the President of the Hakluyt Society, contributes an admirable introduction covering the salient points of Dampier's career, with a digression, "following Shandean precedent" and requiring no apology, upon buccaneering. The text follows that of the four-volume 1729 edition of Dampier's complete works; being, in fact, a reprint of the first volume of that edition.

The maps by Herman Moll which originally accompanied the work are reproduced in facsimile, together with the title-page of the first edition and a specimen page from Dampier's MS. journal. There is also a very excellent reproduction of the well-known portrait in the National Portrait Gallery.

A word of praise should be added as to the format of the book. It is printed on Japon vellum in an excellent fount of type, and most suitably and tastefully bound.

The only criticism which can be offered is that the index, which is of the old-fashioned "higgledy-piggledy" type—having, for example, against the entry "Swan, Capt." no fewer than fifty-three page-numbers, wit h no indication whatever of the particular connection in which any of them refer to that ill-starred mariner—is scarcely in keeping with the high standard set by the rest of the work. R. T. G.

WELTLAGERSTÄTTENKARTE: 8 BL. NEBST ERLÄUTERUNGSband "Bergwirtschaftliche Tabellen." Edited by L. VON ZUR MÜHLEN. Prussian Geological Survey. *Berlin: Dietrich Reimer* 1927. *Text* 9×6 *inches; map portfolio* 13×11 *inches;* vii+312 *pages. M.*80

Taken as a whole this is a most ambitious work. The eight sheets of the world in two hemispheres are on a scale (1/15,000,000) sufficiently large to show satisfactorily what is attempted, except perhaps No. 1 map, where there is necessarily some crowding of signs in the Central European area. By means of an ingenious use of colours and other symbols, an immense amount of detail concerning mineral deposits throughout the world, down to the smallest, is clearly presented. A little practice in using the maps will enable the inquirer to ascertain immediately, with reference to almost any deposit, the place where it is worked (or exists if it is not worked), the class of mineral or minerals abundant in the deposit, the geological age, the mode of occurrence (in strata, lodes, etc.), the relative magnitude of the deposit, and finally, whether mining operations are still in progress, have been abandoned, or have not yet commenced.

Each deposit indicated on the maps bears a reference number by means of which it can at once be identified in the accompanying volume of tabular matter, which supplements in the more precise quantitative form the details shown by mapping; and in addition gives the calorie value or gas content of coals, the percentage of mineral or minerals in the ores, and the outputs in 1913 and in 1924.

This vast material is collected, sorted, classified, and presented in a condensed and serviceable form, and the maps reach a high level of specialized cartography, excellent in their clearness and sustained accuracy.

A work of this kind is produced primarily for those connected directly or indirectly with the mining industry, but as a compendium of one of the leading groups of raw materials, it should also be of service to teachers and students of Economic Geography. Though German is used in the book of tables, a kind of international key is provided by printing the ample legend appearing on the border of each map, twice in each of the four languages: English, French, German, and Spanish. The output figures are, of course, all reduced to metric equivalents.

Since statistical matter comprises a large part of the book apart from the maps, and since, further, its outstanding function must be to serve as a work of reference, a high degree of accuracy is essential to its utility. Whilst almost all the entries investigated by the reviewer stood the test, it is unfortunate that the output figures for such an important product as Chilean nitrates do not agree with those given by the Estadística Minera, the source from which they were taken. E. W. S.

ADVENTURE AND OTHER PAPERS. By FRIDTJOF NANSEN. *London: Leonard and Virginia Woolf* 1927. 7×5 *inches;* 82 *pages.* 3*s* 6*d*

The principal feature of this little book is the inspiring address which Dr. Nansen delivered to the students of St. Andrews University a year ago when he was installed as Lord Rector. It forms a fitting sequel to the addresses of his two immediate predecessors, Sir James Barrie's on Courage and Mr. Rudyard Kipling's on Independence, and great things may surely be expected from the students happy enough to hear all three. In upholding the spirit of Adventure as a stimulus to those entering on their life's career he characterizes that spirit thus:

"It is our perpetual yearning to overcome difficulties and dangers, to see the hidden things, to penetrate into the regions outside our beaten track; it is the *call of the unknown*, the longing for the Land of Beyond, the divine force deeply rooted in the soul of man which drove the first hunters out into new regions; the mainspring perhaps of our greatest actions—of winged human thought knowing no bounds to its freedom."

He illustrates the theme by references to his own life as an explorer when he adopted the principle of going always forward and providing no line of retreat. He develops the analogy between adventure in geographical exploration and adventure in the endeavour to advance human progress in all that has been held essential in civilization.

A strong current of moral earnestness flows through the Address on Adventure and continues through the two shorter speeches delivered in Oslo in connection with the Nobel Peace Prize in 1922 and 1926 on "No More War" and "Peace." This little volume is of value as a biographical document, showing how Dr. Nansen has continued throughout his life to derive inspiration from the spirit of Adventure as much in his present labours for the League of Nations in its philanthropic activities as in crossing the ice-cap of Greenland in the freshness of his youth forty years ago. H. R. M.

THE MONTHLY RECORD

THE NEW ORDNANCE SURVEY MAP OF SCOTLAND

Twenty years ago the 1-inch map of the Ordnance Survey was commonly folded and placed in its covers in such a way that it could be opened like a book to show any section of two-thirds of the whole map without spreading

out the sheet: one could reach two-thirds from the top or from the bottom, and when the progress of the journey required the remaining third the map was opened out, the unwanted third folded under the wanted; and then any section of two-thirds of the map was again available. This was a great convenience to walkers and cyclists, who could open the map as far as immediately required with one hand. When the new Popular Edition of the 1-inch map was brought out in the years immediately following the war, the Ordnance Survey reverted to the old style of mounting and folding, but have now again begun to produce sheets folded in the "outside" style. We have just received Sheet 62 of Scotland, mounted in a very handsome cover, with an admirable characteristic sheet pasted inside the front cover instead of on the lower margin. But the sheet is folded vertically in two instead of in three, as it used to be, so that the size of the covers is $10\frac{1}{2} \times 4\frac{1}{2}$ inches. This is undoubtedly rather large for the pocket, and it may well be that the Ordnance Survey will consider reversion to the older folding vertically in three, which met practically all requirements in a most convenient way. But we should like if we may to congratulate the Survey on the remarkable improvement in the style of their covers, as compared with the unbeautiful things of twenty years ago. The new cover is finely designed in admirable Roman lettering and encourages the hope that we may one day see such lettering on the face of the map itself. The existing sheets of Scotland, recently redrawn, are a great improvement on the old, but they lack a little that air of distinction in style which disappeared from the maps of the whole world early in the nineteenth century: a distinction due entirely to the lettering, and design of margins.

POLISH GEOGRAPHICAL WORK

In noting the receipt of the current number of a Polish geographical journal not previously in the Society's Library, it seems appropriate also to draw attention to the considerable amount of work which is now being done by Polish geographers. The journal in question is the *Travaux* of the Geographical Institute of Posen University, edited by Prof. S. Pawłowski. The number received (Livr. 2–3, 1927) deals with North-West Poland. Among the subjects treated are the character of the sea-floor of the Southern Baltic, the difference in height between the banks of the lower Vistula—attributed to tectonic movements as late as the glacial epoch—and the problem of the Warsaw–Berlin "Urstromtal." A paper of wider interest, perhaps, is the editor's discussion of the distribution of Poles and Germans in the Polish province of Pomerania. This is naturally controversial, for he sets out to prove that in the "Polish Corridor" the Polish settlements are not islands in an alien population, and that Pomerania is not cut off by solid blocks of Germans from the rest of Poland. There are, however, German centres in the south-west and along the Vistula. It is stated that in five only of the eighteen arrondissements is the Polish population less than 75 per cent. of the total. This interest in ethnological subjects is a reflection of Poland's recent history, so that it is not surprising to find similar articles elsewhere. Thus, among recent issues of the *Travaux* of the Geographical Institute of Cracow University, edited by Prof. L. Sawicki, there is one devoted to the wider subject of the relative excess and deficiency of the Polish population throughout the Republic. The author, J. Smolenski, by a formula expressing this factor in relation to area, shows that the solid Polish area centres around Kielce and Łodz and portions of the provinces of Silesia, Cracow, Warsaw, and Posen. The least Polish part of the Republic is in the Sub-Carpathian south-east along the Dneister, and isolated circles in Volhynia and Lvov.

Another recent publication of the same Institute by M. Bieganska-Medwecka discusses the density of the river network in the Małopolska Highlands, and concludes that of the contributory factors the geological is the most important. This series is not confined to local subjects; for instance, Prof. Sawicki has contributed an essay on the geomorphology of Central Ceylon. Prof. Sawicki is also responsible for the *Conférences géographiques*, a series of small popular pamphlets published by the Cracow Geographical Society, and also for the *Revue mensuelle de Géographie*, issued by the Cracow branch of the Polish Geographical Society. The latter chronicles the courses of expeditions and scientific work carried out, and is also a guide to the literature of the subject, Polish and foreign. Another small publication which may be mentioned is the *Revue Cartographique polonaise*, edited by Prof. E. Romer, who is doing much to improve the standard of Polish cartography. Foreign and Polish maps are reviewed, the foreign especially from the Polish point of view in regard to place-names, ethnology, etc. Another geographical institute which is issuing studies is that of Léopol University, where Prof. E. Romer is Director. The last issue was devoted to various aspects of the geography of Podolia, particularly its relief and its hydrography, the latter noticeably a popular subject with Polish geographers.

There remains to be mentioned the important publication of the Polish Geographical Society, published at Warsaw under the editorship of Prof. S. Lencewicz. This is on the usual model, containing, besides lengthy papers, reviews, notes, and bibliographies. The volume for 1926 included a comprehensive paper upon the physical geography, biology, and history of Gibraltar by J. Loth, and a discussion of the natural boundaries of Poland by J. Smolenski, which controverts the thesis that the great European plain in its widest extent is the natural domain of the German state.

Each of these magazines, almost without exception, contains abstracts of the papers either in German, French, or English. It will be seen that the importance of geography is fully recognized in Polish scientific bodies.

WATER-POWER DEVELOPMENT IN CZECHOSLOVAKIA

A systematic programme for the utilization of the considerable water-power resources of Czechoslovakia has been in course of execution under Government auspices for several years, and a statement of the work actually carried out and contemplated was recently issued by the Ministry of Public Works at Prague. It is proposed in time to supply hydroelectric power to the whole state, the necessary funds being provided partly by the state, partly by the separate provinces, and partly by private companies; but the report under notice is concerned with the public operations only. The sites of the working or proposed installations are shown on a map, and particulars of each are given in the letterpress, and are also summarized in a table. The distribution of the sites is of some interest, and though no doubt mainly dependent on the physical character of the waters utilized, they would seem to be chosen also with reference to the needs and present development of the several parts of the State, being spread much more thickly over the Bohemian province than over the rest of the country. As far as numbers go, the installations on the Upper Elbe carry the day, eight stations being either in operation, under construction, or projected, on this river. But those on its tributary, the Vltava (Moldau), will eventually provide a much larger power supply, and even the one station under construction thereon (at Miřejovice) is more important than any completed or nearing completion on the Elbe. The largest station of the future will be that at Slapy on the Vltava, some 20 miles south of Prague,

which will yield 88,000 h.p., while two other stations between this and the capital will supply over 50,000 between them. The stations on the Elbe are for the most part in the upper basin and individually of secondary importance, but one projected at Střekov, some 20 miles above the river's exit from Bohemia, will supply 22,800 h.p. The other parts of the State are not being left out in the cold, for one station is already functioning on the Morava, three in the basin of the Hron, and others are projected on these and other rivers, the most important being that on the Vah at Dolni Kočkovce (20,000 h.p.). For the station at Vranov, on the Dyje, near the southern border of the State, the dam to be built will be 55 metres high and will impound 161 million cubic metres of water, flooding the valley for 30 kil. above its site. This reservoir will be used to regulate the flood-waters, and for irrigation, as well as to maintain the power-supply in dry weather. The total horse-power of the works in operation or nearing completion is over 23,000, but the complete scheme contemplates a total of 224,000, though the funds for the future extensions are not yet provided. The report is fully illustrated.

THE SURVEY OF PALESTINE

During 1927 the Government of Palestine published a ' Note on the Technical System of the Survey of Palestine,' price P.T.10.

The Survey was faced at its birth with a practically non-existent system of land registration, and with a small legacy of war-time triangulation and medium-scale mapping. The most urgent task is that of cadastral mapping. The pamphlet under review is not a report of progress, and does not disclose how far this object has been attained. It discloses however an already completed first-order triangulation, and much progress in third and fourth orders. A second order is evidently not required with so dense a first order (average side 13 kilometres). Many other surveys must envy the progress already attained. By providing this control Palestine has, at any rate, put the horse before the cart. The choice of datum, the adjustment of the various orders, and the scheme of projection are described. There are features which might be criticized if the finances of Palestine allowed of the ideal. It is sufficiently evident, however, that the most rigid economy has been called for and exercised. There is no junction so far with either Egypt or Syria. Some day no doubt we shall see a part of a Mediterranean geodetic enclave through this triangulation. The fifth order is mainly graphic—for the plane-table has been used to save expensive traversing in fixing property beacons. Altogether an encouraging statement. H. S. L. W.

A POLISH EXPEDITION IN ASIATIC TURKEY

We have received from Prof. L. Sawicki, of Cracow University, a short note on a Polish research party which has recently returned from a three-months' visit to Asiatic Turkey. Prof. Sawicki was the geographer of the party, which also included a geologist, an Orientalist, and a Turkish professor of economic geography. As they were equipped with a motor specially designed for scientific work, named the *Orbis*, they were able to cover an extensive area and to make valuable collections. Having crossed the Bosporus they proceeded through the Bithynian peninsula to Ada Pazar, and thence over the West Pontic mountain system (Ala Dagh) by Gerede to Angora. After a short stage up the Qizil Irmaq, they crossed to Yozghad and then struck north to the Black Sea littoral at Samsun. The next areas examined were the East Pontic highlands and the northern extremities of the Anti-Taurus, when their route lay south to Sivas and Qaisari. Here the northern slopes of the

Erjiyas Daghi were a special study. Thence, crossing the Tuz Göli by the famous causeway, they traversed the Central Steppes to Konia that they might examine the Beyshehr Goli region and the Sultan Daghi. The last stages of the journey lay through Bulavadin, Eski Shehv, and Brusa. The total distance covered was 3000 km. The fruits of the journey will appear in volume 2 of the 'Scientific Results of the Voyages of the *Orbis*,' under Dr. Sawicki's editorship.

SCIENTIFIC WORK IN THE CAUCASUS

In the *Journal* for April 1927 we gave a short account, from details supplied by Prof. G. Nikoladze, of the activities of the recently founded Geographical Society of Georgia. Prof. Nikoladze has kindly furnished us with a copy of the report by Mr. S. Djaparidze, a member of the Georgian Society, to the Geophysical Observatory of Tiflis on recent work in the Caucasus. This included an ascent of the eastern summit of Mount Elbrus and three ascents of Mount Kasbek, which secured meteorological observations at high altitudes. In the summer of 1925 a hut had been set up on the summit of Kazbek by Mr. Dideboulidze, and here on 8 September 1926 Mr. Djaparidze placed a barograph, a thermograph, and a minimum thermometer. A week later he brought down the first two instruments, having thus obtained records for the period 8–15 September. The expeditions of 1927 were planned to extend these. The first attempt on August 7 was partly foiled by bad weather; the porters were unable to proceed above 4220 metres. The instruments were therefore deposited and Mr. Djaparidze went on with a guide to the summit. Entering the hut with difficulty through the snow, he found that the minimum thermometer read −72·2° C. During his visit the temperature did not fall below −6° C. On August 15, with two companions, he climbed the eastern summit of Mount Elbrus, the first ascent since 1912. The temperature here was −9·3° C., despite sunshine and a clear sky. The second ascent of Mount Kasbek was made on August 27. Records were obtained from the instruments left at 4220 metres on August 7. These were removed by porters, and the ascent continued through a thick mist. At the top, the minimum thermometer read −22° C. for the period since August 7. All the instruments were left in the hut. Finally, on November 9, an unusual time for such an ascent, a party of the Georgian Geographical Society, favoured by exceptional weather, and again under the direction of Mr. Djaparidze, ascended Kasbek. Further readings were obtained from the instruments left on the previous occasion, but no details are given in the report. All instruments, except the minimum thermometer, were brought down. M. Djaparidze is anxious that steps should be taken to build a stronger observation hut in a better position, for the present one is threatened with destruction by the snow.

TRANSHUMANCE IN THE MIDDLE ATLAS

This subject as a highly complex social phenomenon is dealt with by J. Célérier in an interesting article "La transhumance dans le Moyen-Atlas" appearing in *Hespéris* (Tome 7, 1927). The term "Middle-Atlas" is somewhat loosely applied to the upland tract of plateaux and peaks, about 7000 feet high, which merges on the west into the Tadla plain, on the east into the Muluya plateau, on the north into the Taza shelf and Sebu depression, and on the south fastens on to the High Atlas range. This highland block provides a good deal of precipitation from the humid winds of the Atlantic Ocean, and even in the normally rainless summers of this latitude there are sudden violent thunderstorms. During the wet winter season at lower level

snow falls abundantly at elevations over 6000 feet, but seldom endures long as low as 3000 feet. This heavy snowfall is of great importance in determining a certain type of transhumance in the Middle Atlas. It is explained that transhumance is of two types: the familiar summer type of Mediterranean lands marked by a migration of flocks and herds from the narrow sun-parched coastal lowlands to the encircling mountains; and the winter type, which in Europe is found in the Carpathians and Balkans, and is characterized by an opposite movement (in winter) from the mountains to the plains. In the one case it is drought, in the other cold, which is the compelling factor. In the Middle Atlas both types prevail according to varying local conditions, and some tribes, like the Beni Mguild, practise a double transhumance, and so are virtually nomadic. Taking the Middle Atlas as a whole the winter movement is by far the more important, as it leads the tribes distances of hundreds of miles into foreign territories, whereas the summer movement is essentially local. The winter migration is really a local episode, a phase of the universal tendency which has played such an important part in history for highland tribes to raid the rich plains at their feet.

It is pointed out that the French penetration from the coasts into the mountains was thus in reality a movement contrary to traditional history, and so met with vigorous resistance on the part of tribes ignorant of the real intentions of the French. During the Franco-Sherifian campaign it was the policy to suppress the winter transhumance, but as this seasonal migration is recognized to be a physical necessity for certain tribes, it has recommenced under regulations calculated to avoid internecine strife. As an instance of the difficulties encountered it may be noted that in consequence of the restrictions demanded by the Zaïan chiefs in the north-west of the region, the Aït Bugeman tribe had to leave 10,000 sheep out on the Aarid plateau during the winter of 1926–1927.

THE GOLD COAST FOREST

In No. 7, 1927, of the Oxford Forestry Memoirs, published by the Clarendon Press, Major T. F. Chipp of Kew gives us the first really systematic study of the forest of the Gold Coast, based on extensive personal observations as well as such literature as had previously existed. It is of special interest for its clear demonstration of the practical value of such a study of vegetation—an importance not always fully recognized by geographers. As Major Chipp says in the introduction, "... it is of supreme importance to the local inhabitants to realize at what stages in its development the natural vegetation is of most use to them, what position in the general sequence those stages represent, and what are the controlling factors that produce such stages or retain them, or permit a change to others less or more desirable." And again, with special reference to the Gold Coast: "The value of the economic interpretations resulting from such a study cannot be overestimated in the case of a country almost entirely dependent on the character and maintenance of its vegetation, not only for its material wealth, but ultimately for the very existence of its inhabitants. A narrow strip of country abounding in natural and easily exploitable wealth, and actually 'sandwiched' between an ever-encroaching desert and the sea, is literally dependent on scientific management to retain its existence." Hitherto the work done in the field has thrown little light on the ecology of the Gold Coast forest, and Major Chipp's investigations have been the first decided step in this direction. The climate has been studied both on the basis of local statistics and in relation to that of West Africa in general. The local factors exercising a controlling influence have thus been determined, and the

principal units of vegetation, the characteristics and the structural scheme by which the forest is built up, have been worked out, so that it is now possible to turn to intensive studies awaiting investigation.

In the opening section the author gives a general sketch of the physical characters of the Gold Coast and of the economic activities (cocoa-planting, timber-cutting, etc.) by which the virgin resources of the forest are being constantly encroached upon. This is followed by an account of the forest itself, its limits, and its relation to the main vegetation regions of this part of Africa. The climatology is studied with special care, and the effects of soil and biotic factors duly noted. The rest of the Memoir, which cannot here be dealt with in detail, treats of the units of vegetation and of the individual plant-forms and their distribution. The whole is well illustrated by sketch-maps and photographs representing the main forest types, and there are lists of selected literature at the end of each section.

FRENCH ARCHÆOLOGICAL EXPEDITION IN ABYSSINIA

A detailed account of the archæological results of his recent journey in Southern Abyssinia is given by M. Azäis in *La Géographie*, 48, Nos. 1–2, 1927. M. Azäis had previously made three archæological journeys in Abyssinia; his report therefore deals largely with the archæology of this region in the light of his previous researches, but there is also information on the country, the people and their characteristics. He left Addis Ababa in May 1926, returning in the following November. The first stage was to Silte, the capital of Guragwe Province, whither M. Azäis was attracted by earlier discoveries of menhirs. Excavations under these menhirs, however, proved fruitless, the tombs having apparently been pillaged during the Muhammadan invasion. He then entered the Arusi province, passing between Lakes Zwai and Langana, and examining further tumuli and menhirs *en route*. Turning south along the escarpment east of Lake Shala he reached Allata, in Sidamo, the centre of a region especially rich in monuments. These consisted mainly of groups of granite phallic columns from 2 to 4 metres high, many of which bore "sun" signs and cruciform ornaments oriented to the Southern Cross. As several days' excavation upon one site revealed no burials, he concluded that these were "astral temples." Farther south, near the southern end of Lake Abaya, he found four statues which recalled "la fameuse idole néolithique, la déesse égéenne," guardian of tombs. This he regarded as one of the most noteworthy of his finds and one likely to throw light upon the origin of this Eastern Mediterranean cult. He then proceeded through the Amara country to Burji, where he was surprised to see the surrounding mountain sides carefully terraced for cultivation. From here he struck west across a desert area traversed by the Sagan river to the Konso district, a volcanic massif south of Lake Ganjule. He gives an interesting account of the people of this region; largely of negro origin, especially the women, they live in strikingly neat, clean, and ingeniously built huts. Among themselves they speak a language which they have kept secret from the Abyssinians. Their industries include pottery and the weaving of cotton produced locally, both products being esteemed throughout the country. Another feature is their elaborate and curious graves. M. Azäis was unable to go farther south to Lake Rudolph, so he returned through Gardula and the Gamo mountains to the west of Lake Abaya. On his journey he noted four interesting churches dating from before the Muhammadan invasion, in which valuables and manuscripts had been preserved. Near Addis Ababa he also visited the rock-cut church at Adadi Marian, the forerunner apparently of the more famous

churches at Lalibala. During the journey he took a large number of photographs, of geographical as well as of archæological and ethnological interest.

THE SURVEY OF SOUTH AFRICA

The Report for 1926 of the Director of Trigonometrical Survey in the Union of South Africa is an encouraging record of progress in filling up the space of the geodetic triangulation with supplementary first-order work, and in extending a second order. About sixty first-order points and five hundred of the second order have been observed at. The Director makes it clear that he much prefers to employ a definite whole-time staff, to putting observation out to contract. The drought and dust of 1926 would seem to have made observation difficult, but indeed South African surveyors can have little to grumble at, generally, in their atmospheric conditions. It is interesting to see that Mr. Whittingdale, the Editor of the interesting *South African Survey Journal*, joins the staff of the trigonometrical survey.

South African geodesy has for long taken a high position in the Empire. We should like to see, however, a companion report on topographical survey. Commission and discussions on this question there have been no lack of, but somehow nothing much seems to happen.

SURVEY OF THE UPPER ZAMBEZI

It has recently been reported in *The Times* that a contract for the air survey of the upper waters of the Zambezi river has been placed by the Northern Rhodesian Government with the Aircraft Operating Company. This company has completed aerial surveys in Northern Rhodesia for mining concessions. The survey extends from Livingstone about 400 miles up the river, and includes the Lungwebungu tributary to the Angola boundary and a considerable portion of the Kabompo. A series of vertical photographs are to be taken at a height of 10,000 feet, and larger-scale maps of the rapids are to be made. The ground control is to be provided by points determined by astronomical observations and wireless time signals. The scope of the survey has later been extended to examine the possibilities of river and railway communication between Livingstone and Lobito Bay under contract with the Benguella Railway. The Portuguese Government has given permission for the survey of the portion of the Lungwebungu river within their territory. Flying was to commence in December. It has also been reported in *The Times* that the Benguella Railway reached the Angola–Belgian Congo boundary south of Bukama at the end of November last. The total length now built from Lobito Bay is about 780 miles. The Belgian Government has undertaken to effect the junction with the Katanga Railway.

COAL IN NEW BRUNSWICK

The presence of coal in New Brunswick was known to the early settlers, and it is said that in the seventeenth century a schooner from Boston sailed up Grand Lake and returned with a cargo of it. Regular mining was begun, but on a very small scale, in 1825, and even in 1890 the yearly production was only 7000 tons, and in 1900 10,000. But in the past few years, thanks largely to the opening of railway communication with the coalfield, the production has assumed far more important proportions, and in 1923 over 250,000 tons were mined. The growing importance of the field made it advisable to study the geology and coal resources of the area in the central part of the province, approximately 400 square miles in extent (known as the Minto basin from the village which is the centre of mining activity) more thoroughly than had been

done previously. The task has been carried out by Mr. W. S. Dyer for the Geological Survey of Canada, and the results are recorded in Memoir 151 of the Survey. The basin forms part of the great Carboniferous plain of New Brunswick, and is a tract of low relief, mantled by glacial drift, but dissected by small streams which flow into Grand Lake and have cut deeply into the carboniferous sediments. The report describes the formations in detail, and then discusses the coal deposits from the economic side. The surface seam, from which alone the coal is mined, lies in low irregular folds and is found over nearly the whole of the basin, reaching a thickness of 24 inches in the south-western part, but becoming much thinner in the north and east. Over large areas it is quite near the surface, but in others it is as much as 125 feet down. The ease of mining makes it profitable to work seams down to 18 inches thick. The coal has good steam-producing qualities, and more than 70 per cent. of the output is sold to the railways, but there is also a demand for the coal for industrial and domestic purposes in New Brunswick and Maine, and the market should increase as the rail-haul is much shorter than in the case of Nova Scotia coal. The reserves actually proved to exist are calculated at over 8 million tons, but if probable and possible reserves are included the grand total is over 235 millions.

THE PONGO DE MANSERICHE

The most detailed and scientific description yet given of the famous Pongo de Manseriche—the most formidable of the series of rapids which mark the course of the Marañon or Upper Amazon through the eastern ranges of the Andes—is due to Mr. J. T. Singewald, who carefully examined the canyon during geological explorations, in company with Mr. E. C. Roschen, in 1925. It has appeared in the *Bulletin of the Geological Society* of America, vol. 38, pp. 479–492, 1927, having been presented in abstract before that Society in December 1926.* The Pongo de Manseriche occurs where the river cuts its way through the easternmost range of the Andes, in order to emerge on to the flat plains of the Amazon basin. Ascending from these the range appears ahead as an even line broken only by the notch cut by the river, this appearance being partly due to a line of foothills which fall to the west by escarpment slopes and to the east by more moderate dip slopes. The length of the canyon along the course of the river is 4 miles, the width varying from 300 to 700 feet. (Both the narrowness of the channel and the height of the bounding walls have been exaggerated by some travellers.) The stream is everywhere swift, but the most turbulent rapids and whirlpools occur where *débris* have been brought down by tributaries or where ledges of hard rock project into the river. The danger of navigation varies greatly, not only according as the water is rising or falling, but according to the rate of the rise or fall. Geologically, the pongo is cut almost at right angles to the axis of an anticline which forms the Cordillera Oriental. The oldest formation exposed in the centre of the anticline is a thick-bedded quartzitic sandstone, which forms walls rising to 1000 feet. The lowest beds dip very steeply to the west but more gradually to the east, the steepness however increasing in this direction until the dip is vertical at

* The Pongo has been known from quite early times, having been visited, among others, by Father Samuel Fritz, La Condamine, and Humboldt. In modern times it and the other rapids have more than once been navigated, as *e.g.* by Capt. Carbajal in the steamer *Napo* in 1868, by A. Wertheman, in rafts, in 1870, and more recently by Señor Muro, both by canoe and motor boat (cf. *Journal*, 64, p. 26).

the mouth of the Pongo. On this side faulting has interrupted the sequence. On either side the Pongo sandstone is overlain in succession by (1) A shale-limestone series of Cretaceous age with ammonites, etc.; (2) beds of massive red sandstone; (3) the younger Tertiary, beyond the limits of the pongo. The expedition succeeded in finding fossils in the Red Beds, which seem to be of Upper Cretaceous or older Tertiary age. As all these formations have been involved in the uplift of this eastern range, while Pliocene beds in adjacent areas are undisturbed, the date of the uplift may be put down as late Miocene.

THE ARGENTINE PAMPAS

The question why the Argentine Pampas—formerly grass-covered but now largely given over to agriculture—are almost entirely treeless, has provoked some discussion, though not perhaps to the same extent as that of the treelessness of the North American prairies. It has been generally assumed that the lack of trees is the result of natural conditions, mainly climatic; but this view is contested by Oscar Schmieder in *University of California Publications in Geography*, vol. 2, No. 8, 1927. Although the boundary between the Pampas and the bush-covered *Monte* to the west is differently drawn by different writers (being in fact impossible of exact definition), there is certainly no relation between the extent of the former and the soil conditions, for the whole of the Argentine plain is composed of young horizontally bedded sediments, which extend far beyond the limits of the Pampa prairies. The main climatic features are the decrease of rainfall and increase of temperature as we pass west and north-west from the Atlantic seaboard, the decrease in rainfall being associated with a concentration into the summer months, in contrast with a nearly uniform distribution through the year farther east. The interior climate is not favourable to luxuriant tree growth, hence the development of an association of hard-leaved scrub or trees—the *Monte bajo* and *Monte alto* of the natives. The remarkable fact, which has attracted attention from early times, is that the more eastern plains, with their greater humidity, produced extensive treeless prairies, and this has been accounted for by some as the result of strong winds, by others as due to underground water. But neither of these explanations will hold, and the fact that trees grow easily wherever planted in the Pampa, proves that the area has not by any means a "grassland climate" hostile to tree growth. Again, records exist showing that groves and even forests of some extent were once to be seen on the eastern plains. The writer therefore holds that a primary tree growth has been destroyed by man's agency, quoting documents which show both that there was a large Indian population when the Spaniards first arrived, and that they had a regular custom of burning the vegetation, by which in course of time the grass areas would extend at the expense of the trees. This conclusion accords with the view of Mr. Miller Christy in regard to North America in his article "Why are the Prairies treeless?" printed in the *Proceedings* R.G.S. for January 1892.

THE BYRD ANTARCTIC EXPEDITION

Commander R. E. Byrd, U.S.N., is planning an expedition to the Antarctic next year, and he has kindly sent us some details of his plans. Though he hopes to fly to the South Pole, and perhaps to cross the Antarctic continent, the main objects of the expedition will be scientific, and the flights will be subsidiary to them. Ten specialists, who, it is expected, will be lent by various American scientific bodies, will form part of the *personnel*, and every effort is to be made to forward their researches. Among the remainder of the party will be fifteen selected men with previous Arctic experience, with Isack Isackson,

Commander Byrd's ice-pilot on his North Pole expedition. The equipment is to include fifty Eskimo dogs, and snow tractors for moving the aeroplanes and stores. The machines will probably be one large tri-motor monoplane, similar to that used on his recent trans-Atlantic flight, and one or two small single-engine monoplanes. Commander Byrd is hopeful that it will be possible to take off from open water despite the ice that will form at low temperatures on the floats, but he is to make experiments during the winter in Canada. An ice-worthy ship will be chartered and portable huts taken, so that the expedition can, if necessary, winter on the Barrier.

It is proposed to leave next summer, and after calling at South American and New Zealand ports, to enter the Ross Sea about the middle of December or as soon after as the ice conditions permit. The main base will probably be established at the Bay of Whales, where previous experience has shown that calm-weather conditions may be expected, for the Antarctic blizzard is likely to prove one of the obstacles to the air programme. After the main base has been formed some distance from the edge of the Barrier, the dog teams will be used to lay down smaller bases towards the Pole, four or five bases 100 miles apart. These will be useful in case of mishap on the Polar flight, and will also serve as centres for short trips into the surrounding areas. Commander Byrd hopes to accomplish some survey work by aerial photography, particularly along the coast of King Edward Land to the east of the Bay of Whales, one of the remaining major gaps in our knowledge of the Antarctic coast-line. The trans-continental flight across the Pole to the Weddell Sea will probably not be attempted on the first expedition. Unless the expedition wintered on the Barrier, it would have to leave by the beginning of March.

MAN'S MODIFICATION OF THE EARTH'S SURFACE

We have received from Prof. G. Wegener of Berlin a reprint of an address on "Man and the face of the Earth," published in the *Geographische Zeitschrift*, Heft 8, 1927. Touching upon the constant emphasis laid on the influence of geographical factors upon man, he remarks that the contrary influence of man upon the Earth's surface, which he regards as an exogenous force similar, for example, to erosion, has not received equal attention. There has, of course, been a reaction against the extreme views of geographical influence (though the writer does not refer to this tendency), and again the *rôle* of man as a geological agent, and as such a modifier of the Earth's surface, has been treated in some detail. It soon becomes evident from the paper, however, that the writer is chiefly concerned with the "Landschaftsbild," the collective phenomenon, physical, botanical, etc., which combine to produce a natural region, a conception hardly expressed by our term "landscape." Thus he points out the difference between the surface of Germany now and in the time of Tacitus. The forests and swamps are gone: 25 per cent. of the forest area is cleared and in cultivation, while the remaining forest has undergone a change, economic trees having replaced the former constituents, for example, pines in the place of oaks. Hardly a German river remains unregulated, and the constant struggle with the North Sea has resulted in great changes in the coast-line. These influences are not limited either to modern times or to Europe. He contrasts strongly the probable condition of Egypt before the advent of man—a swampy, heavily vegetated country, subjected to constant flooding, the home of ferocious animals—and its condition under the early Pharaohs, with the river controlled and utilized, the jungle cleared and the beasts exterminated. The work of the Romans in Italy is equally striking.

These and similar reflections lead the writer to exclaim that every "Landschaftsbild" owes its characteristics to the work of man. It is interesting to note in passing that other students, however, have found physical characteristics the ultimate basis of such divisions.

Turning to a consideration of general factors he shows, for example, that though man's influence upon the sea is naturally small, yet a quarter of Holland is below sea-level, and similar conditions prevail in the Yangtse delta, and certain limitations to its utilization as an agent of traffic have been destroyed by the cutting of the Suez and Panama canals. In the plant world man's influence has been great: this is typified by the present range of wheat and maize. Again, though he cannot control climate, he has managed to mitigate some of its hardships by the almost world-wide practice of irrigation. What the writer considers to be the most srtiking general example of his thesis is supplied by Australia; two hundred years ago an isolated continent, practically uninhabited, with an almost fossil flora and fauna, now boasting a European fauna and temperate and sub-tropical vegetation. As the pressure of world population is increasing, Prof. Wegener urges that these influences of man must be further intensified, and proposes further study in this direction. While it is obvious that the expression of this point of view is valuable as a corrective, it may be doubted whether it is necessary to undertake geographical study solely to illustrate it, or indeed any other theory.

INTERNATIONAL GEOGRAPHICAL CONGRESS, CAMBRIDGE, 1928

At the meeting of the General Assembly of the International Geographical Union held at Brussels in 1924, it was, on the proposal of the British delegates, unanimously decided that the International Congress of 1928 should be held in England. In accordance with the statutes of the Union the British National Committee for Geography is responsible for the organization, and they have decided that the general convenience of the delegates will best be suited if certain preliminary ceremonies take place in London, and the administrative and scientific meetings are held at Cambridge. This is approved by His Majesty's Government and by the University of Cambridge. The Congress, under the Presidency of General Vacchelli, will open in London on July 14, removing to Cambridge on July 17 until July 25. The Congress is organized in six sections, which will meet under their own presidents. Certain subjects have been selected for discussion and referred to Commissions of the Union, which will report upon them to the Assembly. These are the International 1/M Map, Rural Occupation, and Pliocene and Pleistocene Terraces. Contributions on the following subjects will also be welcomed: the variation of climates, the flora and fauna of high mountains, and the map of internal drainage areas. The subscription payable by all members of the Congress is £1. Reduced fares are offered by railway and steamship companies. Full details can be obtained from The Secretary, International Geographical Congress, Caius College, Cambridge.

GREENWICH TIME-SIGNALS FROM RUGBY

The time-signal described in the *Journal* for November on page 477 was established on the morning of December 19, after preliminary transmissions had been heard in the preceding week. Henceforward the "Standard Rhythmics" will be sent in the series of 306 signals emitted in 300 seconds of mean time, from $09^h\ 55^m\ 00^s$ to $10^h\ 00^m\ 00^s$, and from $17^h\ 55^m\ 00^s$ to $18^h\ 00^m\ 00^s$ each day, the signals which fall on the whole minutes being lengthened and thus emphasized. There are no preliminary calls and no signature; nothing but

the series of 306 signals. It is anticipated that the time signalled will usually be correct within about 0·02, and since the Rugby station undertakes to communicate with ships in any part of the world, we may presume that surveyors will have very little difficulty in receiving these signals anywhere. But confirmation of this will be valuable; and we shall be glad to receive from distant observers notes on the reception of the Greenwich signal, indicating the dimensions of aerial or frame, number of valves, kind of circuit, strength of signal, and whether regular or interrupted.

OBITUARY

MR. REGINALD SUGGATE

Fellows of the Society who remember the old House in Savile Row will learn with regret of the death of Mr. Reginald Suggate, who was for over fifty years in the employ of the Society and who retired from his position as clerk in the office a few months after the move to Kensington. He died at Ludham, Norfolk, on December 12, having enjoyed his well-deserved pension for fourteen years, and solaced his retirement with the violoncello on which he was an accomplished performer, playing without break in the Handel Festival Orchestra from 1868 to 1913.

MEETINGS: SESSION 1927–28

First Evening Meeting, 7 November 1927. Admiral Sir William Goodenough, K.C.B., Vice-President, in the Chair

Paper: Two Journeys in Eastern Greenland. By Dr. Lauge Koch

First Afternoon Meeting, 14 November 1927. Major-Gen. Lord Edward Gleichen, K.C.V.O., Vice-President, in the Chair

Paper: The Triangulations of Africa. By Col. H. S. L. Winterbotham and Capt. G. T. McCaw

Second Evening Meeting, 21 November 1927. Colonel Sir Charles Close, President, in the Chair

Elections: Percy Wilfred Alder; Rev. Canon Edwin Coupland Aspinall; Michael Hunter Atkinson; Mrs. Florence Ayscough; Albert Bailey; Fane Fleming Baxter, O.B.E.; Dr. William Beebe; Ernest Bennett; Hilton Betteley; Harold Ephraim Blaiberg; Miss Lilian L. Boulton, L.L.A.; Capt. W. M. Broomhall, M.B.E., R.E.; Albert Edward Broué; Kenneth Brown; Ernest John Bryce; Mrs. Charles Bruce; The Hon. Mrs. Victor Bruce; William Henry Bundock, M.SC.; Thomas Henry Bury; Richard Austen Butler; Lieut. I. M. Cadell, R.E.; Dugald Campbell; Sydney Howard Chance; Miss Daisy M. Chown; Capt. Merian C. Cooper; Capt. V. F. Craig, R.E.; Herbert Lindsay Crawford, B.A.; Charles Pelham Curtis; Capt. F. J. Danby-Hunter; A. Edward Davis; George Henry John Daysh, B.LITT.; William Norman Dolton; The Lord Dunsany; Miss Ada Earp, L.L.A.; John T. Easterbrook, C.B.E.; Henry Elford-Gulley; Mrs. Nina Benson Hubbard Ellis; Robert Jocelyn Evans, M.A.: Robert M. Ffinch; Varrick Frissell; R. Gordon Gallien, C.E.; Alexander McAndrew Gillespie, M.B., CH.B.; The Rev. James Rodolph Glover; Alexander Robert Greene; Edward Algernon Hall; Andrew Hannay; Frank Harrison; Thomas John Havard, B.SC.; Thomas Hay; Capt. George Frederick Heaney, R.E.; Leslie

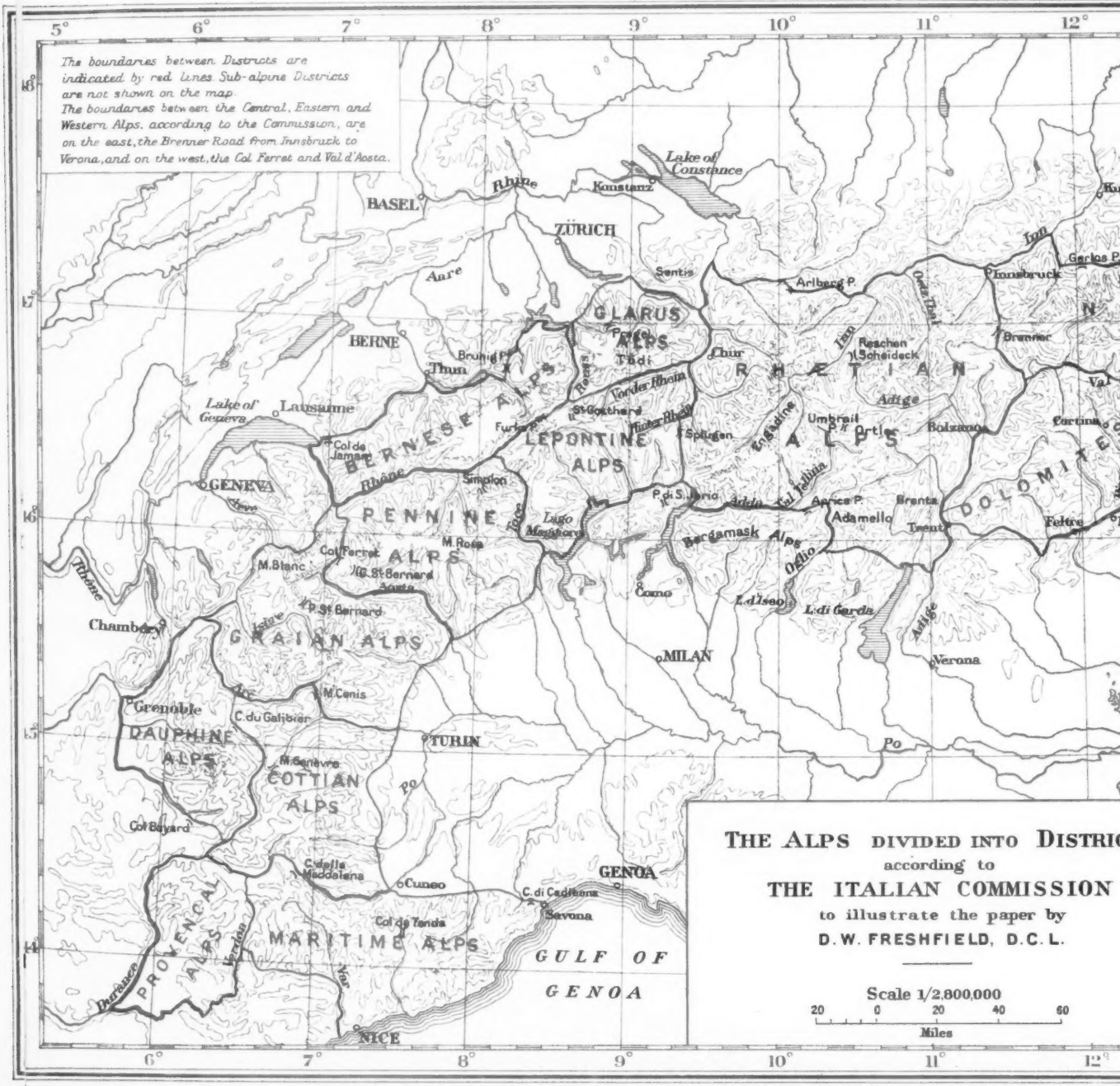
Hickmott-Hickmott; Howard Hollingsworth, C.B.E., J.P.; Mervyn Thomas Edward Hooley; Miss Diana Houghton-Rogers; Lieut. Ivor Thomas Percival Hughes; Capt. Arthur Hulbert; Tom Edward Hull; Malcolm Portal Hyatt; John Frederick Crompton Inglefield; William Ross Irving; Thomas Lavington Jacks, C.B.E.; Major Frederick George Jackson; H. C. Jackson; Percy Shaw Jeffrey, M.A.; Ramplin Jones; Md. Ibadur Rahman Khan, B.A.; Commr. the Hon. J. M. Kenworthy, R.N., M.P.; Kenneth P. Kirkwood, M.A.; Miss Margaret Evelyn Lambrick; Harry Arthur Lane; John M. Lee; Laurence F. Leonhardt; Lionel Leslie; Sydney Lloyd, B.SC.; Robert Paton Longden, B.A.; Percival Arthur Lund, B.SC.; Herbert Douglas Dix Mackay; John A. McMichael; H. A. Macrea, M.B.E., M.A.; Jack Grenville Maitland-Edwards; Gordon Manley; Ivan Donald Margary, M.A., F.R.MET.SOC.; The Rev. William Thomas Martin, M.A., F.Z.S.; Hubert Frank Mathews, M.A., F.R.A.I.; Donald Mennie; Basil Mitchell; Thomas Walter Mitchell; Patrick Dighton Moore; Col. Thomas Cecil Russell Moore, C.B.E., M.P.; Thomas Arthur Erskine Muir; Capt. Nicolas Mukaloff; Mrs. Hubert M. Murray; Hugh St. Denys Nettleton, B.A., LL.B.; Capt. Thomas Nevill Carleton Nevill; Miss Caroline Nias; Desmond O'Connor; Reginald Wilson Orcutt; Lt.-Commr. Denis Hathaway Pasmore; Vivian Petherick; Henry Pickering; Capt. Charles Harold Pratley; C. A. Radley; The Rev. Apsley Sidney Burdett Ranger, M.A.; Herbert Christopher Robinson; The Rev. Alfred James Rolfe, M.A.; Major Roger Sanguinette, O.B.E., M.C.; John Sawyer; Ernest B. Schoedsack; George Sheppard, PH.D., B.SC., F.G.S.; The Rev. Vernon Henry Sherwin; Albert Allen Simpson, C.M.G., C.B.E.; Miss Charlotte A. Simpson, B.SC.; Walter Arthur Sims; Major William Wilson Soden-Irwin; David Stuart Spurrell; Franz St. Blase Stanley; Major Arthur Ramsay Stanley Clarke, R.A.F.; Ralph Stewart Starr; Algernon Gould Story; Evan David Glyn Thomas; John Dunlop Thomson; Reginald Francis Thomson; Miss Margaret Thorpe, L.L.A.; John Rodney Turnbull, M.A.; K. S. Vakil, M.E.D.; Guy Waddington, B.SC.; Wing Commr. A. A. Walser, M.C., D.F.C., R.A.F.; Miss Dorothy J. Webb; Capt. Thomas Herbert Wheat; David Trevor Williams, M.A.; Capt. John Williams, F.R.A.S., F.R.MET.SOC.; The Rev. Claude C. H. Williamson, O.S.C.; Edward Archibald Rathwell Wilson; James Spetch Wilson, J.P.; Major Ronald Wyman; William Warren Zambra, M.A.; The Baroness Zouche.

Paper: The Blue Nile. By Major R. E. Cheesman (read in his absence by Col. H. S. L. Winterbotham)

Third Evening Meeting, 5 December 1927. Colonel Sir Charles Close, President, in the Chair

Elections: Major Ralph Alger Bagnold, R.C.S.; Miss Muriel Hermione Cooper; Claud Cranbrook Lewis de Grenier; Lieut. Francis W. de Guingand; Lieut. Cyril Lancelot Everard Drake-Brockman; Lieut. William Moir Matthews Duncan; Horace Ernest Edwards, B.A.; Arthur Joseph Hughes, O.B.E.; Commr. Edward Montagu Hussey-Cooper, R.D., R.N.R.; W. Edgar Jackes; Ernest Edward Jolly; Capt. C. J. Keegan; Cecil Howard Learner; Capt. J. S. Phillips, M.C., B.A.; Major the Rev. S. R. Rees; Gerald Seligman; John William Swindells; Harry Sykes; Miss Ivy Mary Thomas, B.A.; Thomas Clegg Turner; Miss Clare Gray Ward; Capt. Francis Weldon-Walshe, O.B.E., M.V.O., R.N.; Joseph Henry Willson.

Paper: Lubaantun. By Major J. C. Cooper Clark and Mr. Geoffrey Laws



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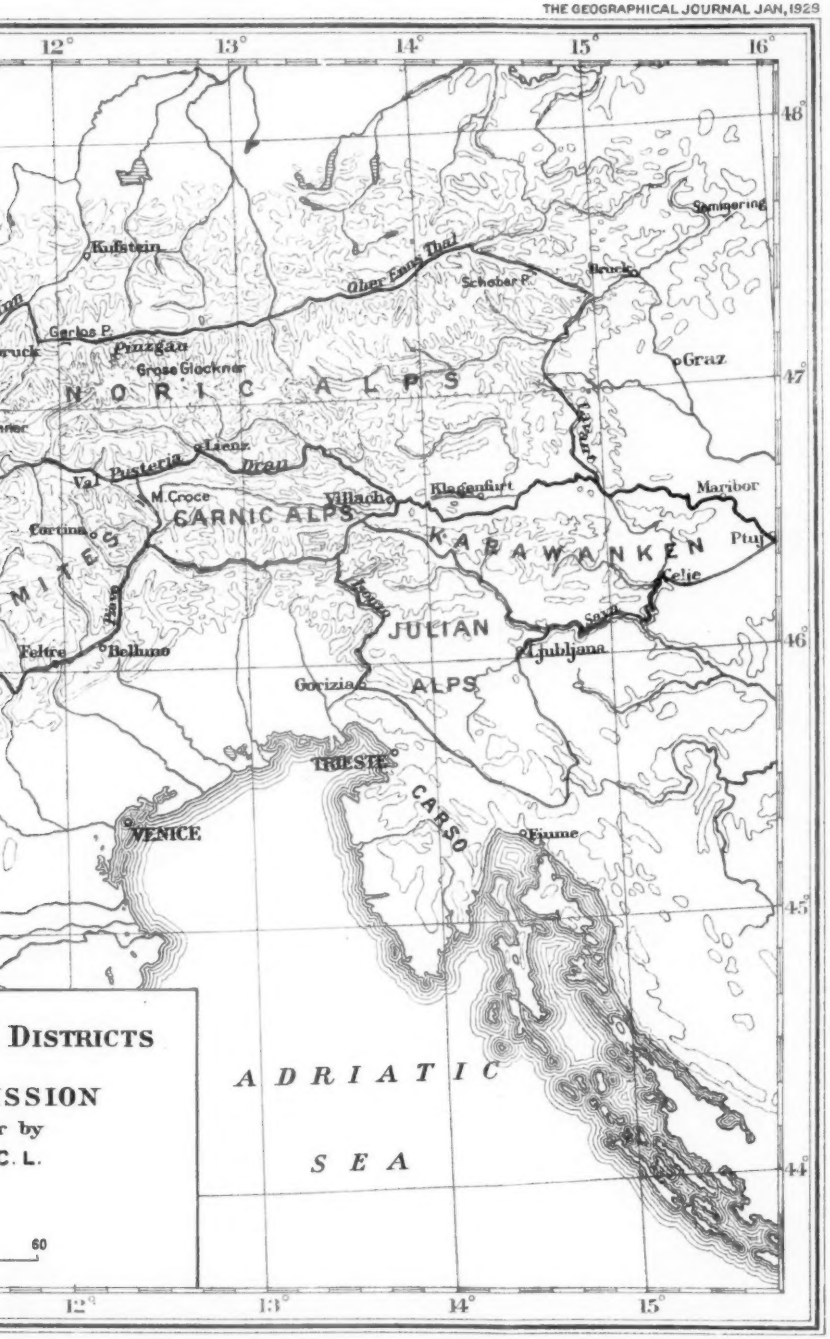

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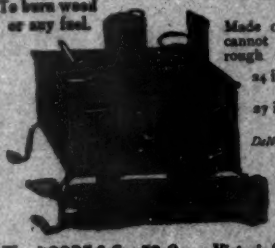

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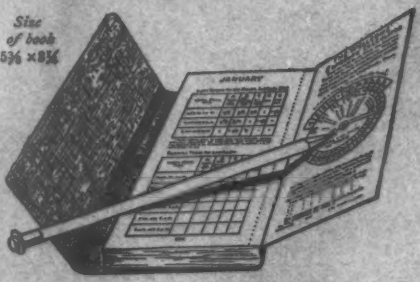

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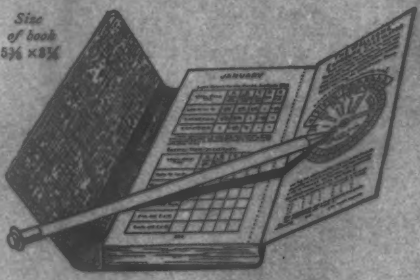

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